The Arizona Commission

—OF—

Agriculture and Horticulture

FOURTEENTH ANNUAL REPORT

1912

For the Year Ending June 30th, 1922

Page

Page 85,
author

ARIZONA COMMISSION
of AGRICULTURE & HORTICULTURE
EXHIBIT FROM OFFICE OF STATE ENTOMOLOGIST
SOUTH AMERICA
INDIA
UNITED STATES
PLANT INSPECTION WORK

EXHIBIT OF STATE ENTOMOLOGIST'S OFFICE
Arizona State Fair, Phoenix

The Arizona Commission

—OF—

Agriculture and Horticulture

FOURTEENTH ANNUAL REPORT

For the Year Ending June 30th, 1922

CONTENTS

PART I.

PAGE
Arizona Commission of Agriculture and Horticulture and Fourteenth Annual Report 11
  Report of Secretary 11
  Personnel of Commission 11
  State Entomologist 11
  Official Acts of the Commission 12
  District Inspectors 18
Financial Report 22
Receipts and Expenditures 24

PART II.

Annual Report, Letter of Transmittal 25
  Lines of Work 25
  Plant Quarantine Inspection Service 27
    Inspection of Shipments of Nursery Stock, Fruit and Other Plant Products 27
    Parcel Post Shipments 30
    Pests Intercepted 30
    Nursery Inspection 32
    Sources of Plant Shipments 34
  Safeguarding Cotton Cultures 35
    Automobile a Factor in Spreading Pests and Plant Diseases 35
    Inspection of Cotton Fields, by J. H. O'Dell 36
    The Thurberia Boll Weevil 38
    Prosecution for Violation of the Mexican Boll Weevil Quarantine 41
    Cottonseed Importation from California Permitted 41
  The Citrus Fruit and Nursery Quarantine 43
    Automobile a Factor in Spread of Citrus Pests 43
    Citrus Nursery Stock 43
    Safeguarding the Alfalfa Crop 45
    Date Palm Scale Eradication 45
  Bee Disease Eradication 47
  Potato and Deciduous Pest Control 49
  Unclassified Miscellaneous Work 49
    Fair Exhibits 50
    Co-operation 50
  List of Current Quarantine and Other Restrictive Orders 52
    Arizona Quarantines 52
    Federal Quarantines 53
    Other Restrictive Orders 54

PART III.

Insects Injurious to Arizona Crops During 1922, by Perry A. Glick 55
  Deciduous Fruits and Vines 55
    Peach Tree Borer (*Anarsia lineatella*) 55
    Flatheaded Apple Tree Borer (*Chrysobothris femorata*) 55
    Codling Moth (*Carpocapsa pomonella*) 55
    June Bug (*Cotinus mutabilis*) 56

PAGE

- San Jose Scale (*Aspidiotus perniciosus*) 56
- Grape Leaf Hopper (*Erythroneura comes*) 56
- Salt Marsh Caterpillar (*Estigmene acraea*) 56
- Grape Leaf Skeletonizer (*Harrisina brilliana*) 57
- Grasshoppers (*Melanoplus differentialis* and *M. femur-rubrum*) 57

Citrus and Subtropical Fruits 57
- Citrus Thrips (*Scirtothrips citri*) 57
- Cicada (*Cicada cinctifera*) 57
- Soft Brown Scale (*Coccus hesperidum*) 57
- Cottony Cushion Scale (*Icerya purchasi*) 58
- Pomegranate Bug (*Leptoglossus phyllopus*) 58
- Parlatoria Scale (*Parlatoria blanchardii*) 58
- Ladybird Beetle (*Axion plagiatum*) 59
- Marlatt Scale (*Phoenicococcus marlatii*) 59

Field and Forage Crops 59
- Sugar Cane Borer (*Chilo loftini*) 59
- Corn Stalk-borer (*Diatraea lineolata*) 59
- Corn Ear Worm (*Chloridea obsoleta*) 59
- Corn Flea Beetle (*Chaetocnema ectypa*) 60
- Grasshoppers (*Melanoplus differentialis* and *M. femur-rubrum*) 60
- Cutworms (various spps.) 60
- Aphis (*Aphis* sp.) 60
- Alfalfa Caterpillar (*Eurymus eurytheme*) 60
- Bean Thrips (*Heliothrips fasciatus*) 61
- Clover Seed Chalcis (*Brucophagus funebris*) 61
- Three-cornered Alfalfa Hopper (*Stictocephala festins*) 61
- Darkling Beetle (*Discodemus reticulatus*(?)) 61

Vegetable and Truck Crops 62
- Tomato Beetle (*Ulus crassus*) 62
- Tomato-stalk Beetle (*Trichobaris mucorea*) 62
- Grain Bug (*Chlorochroa sayi*) 62
- Bean Ladybird Beetle (*Epilachna varivestris*) 63
- Corn Ear Worm (*Chloridea obsoleta*) 63
- Cabbage Butterfly (*Pontia rapae*) 63
- Cabbage Looper (*Autographa brassicae*) 63
- Harlequin Cabbage Bug (*Murgantia histrionia*) 63
- Colorado Potato Beetle (*Leptinotarsa decemlineata*) 64
- Potato Blister Beetle (*Epicauta pardalis*) 64
- Aphis (*Aphis gossypii*) 64
- *Aphis brassicae* 64
- Cutworms (various spps.) 64
- Western 12-Spotted Cucumber Beetle (*Diabrotica soror*) 64
- Melon Aphis (*Aphis gossypii*) 65
- Leaf Beetle (*Deloyala clavata*) 65
- Salt Marsh Caterpillar (*Estigmene acraea*) 65
- Grasshoppers (*Melanoplus differentialis*, *M. femur-rubrum* and *Dissosteira carolina*) 66
- False Chinch Bug (*Nysius minutus*) 66

Cotton Insects 66
- Cotton Bollworm (*Chloridea obsoleta*) 66
- Cotton Leaf Perforator (*Bucculatrix thurberiella*) 66
- Salt Marsh Caterpillar (*Estigmene acraea*) 66
- Cotton Leaf Worm (*Alabama argillacea*) 66
- Arizona Cotton Stainer (*Dysdercus albidiventris*) 67
- Cotton Square Dauber (*Lygus elisus* var. *hesperius*) 67
- Brown Cotton Bug (*Euschistus impictiventris*) 67
- Green Cotton Bug (*Chlorochroa sayi*) 67
- Cotton Aphis (*Aphis gossypii*) 67
- Differential Grasshopper (*Melanoplus differentialis*) 67
- Cicada (*Cicada cinctifera*) 68

Shade Trees and Ornamentals 68
- Cottonwood Leaf Miner (*Proleucoptera albella* Cham.) 68
  - Life History 69

CONTENTS—Continued

PAGE
- Enemies 72
- Control 73
- Goldsmith Beetle (*Catalpa lanigera*) 73
- Flatheaded Apple Tree Borer (*Chrysobothris femorata*) 73
- Common Red Mite (*Tetranychus telarius*) 73
- Ivy or Oleander Scale (*Aspidiotus hederae*) 74
- Soft Brown Scale (*Coccus hesperidum*) 74
- Rose Scale (*Aulacaspis rosae*) 74
- Cottony Cushion Scale (*Icerya purchasi*) 74

Household Insects 74
- Silverfish or Fishmoths 74
- Roaches (*Periplanata americana*) 75
- Carpet Beetle or "Buffalo-Moths" (*Anthrenus scrophulariae*) 75
- Clothes Moths (*Lepidoptera*) 75
- House Ants 75
- Fleas 76
- House Fly (*Musca domestica*) 76

Attention 77

PART IV.

The Survey of Myelois venipars Dyar in Arizona by [redacted] Perry A. Glick [redacted] 78
- The Survey 78
- Host 79
- Types of Oranges 81
- Importance 84
- Control 88
- Life History 88
- Natural Enemies 96
- Summary 96
- Bibliography 97

PART V.

Notes on Plant Diseases in Arizona, 1922, by D. C. George 98

Plant Diseases New to Arizona 98
- Orange Rust (*Gymnoconia insterstitialis*) 98
- Root and Stalk Disease of Field Corn 99
- *Pseudomonas dissolvens* n. sp. 99
- Cluster-cup Rust (*Aecidium* sp.) 100
- Head Smut (*Sphacelotheca reiliana*) 100

Diseases of Deciduous Fruits, Small Fruits and Vines 100
- Crown Gall (*Bacterium tumefaciens*) 100
- Texas Root Rot (*Ozonium amnivorum*) 101
- Fire Blight (*Bacillus amylovorus*) 101
- Leaf Spot Disease (*Septoria rubi*) 102
- Grape Powdery Mildew (*Uncinula necator*) 102

Citrus Diseases 102
- Damping Off (*Rhizoctonia*) 102
- Brown Rot Gummosis (*Pythiacystis citrophthora*) 102
- Black Rot (*Alternaria citri*) 104
- Psorosis or Scaly Bark 104

Diseases of Field and Forage Crops 105
- Texas Root Rot (*Ozonium omnivorum*) 105
- *Phymatotrichum omnivorum* 105
- Leaf Spot (*Pseudopezizza medicaginis*) 105
- Downy Mildew (*Peronospora trifoliorum*) 105
- Loose Smut (*Ustilago nuda*) 105
- Covered Smut (*Ustilago hordei*) 105
- Black Stem Rust (*Puccinia graminis*) 105
- Corn Smut (*Ustilago zeae*) 105
- Loose Smut (*Ustilago avenae*) 105
- Kernel Smut (*Sphacelotheca sorghi*) 105

CONTENTS—Continued

PAGE
Bacterial Blight (*Bacillus sorghi*) 105
Stinking Smut (*Tilletia tritici*) 105
Diseases of Vegetable and Truck Crops 105
Bacterial Blight (*Pseudomonas phaseoli*) 105
Anthracnose (*Colletotrichum lagenarium*) 106
Bacterial Soft Rot (*Bacillus cartovorus*) 106
Scab (*Actinomyces scabies*) 106
Rhizoctonia Disease 106
Early Blight (*Alternaria solani*) 106
Dry Rot (*Fusarium* sp.) 106
Texas Root Rot (*Ozonium omnivorum*) 107
Anthracnose (*Colletotrichum lagenarium*) 107
Cotton Diseases 107
Angular Leaf Spot (*Bacterium malvacearum*) 107
Texas Root Rot (*Ozonium omnivorum*) 107
Phymatotrichum omnivorum 108
Sore-shin (*Rhizoctonia* sp.) 108
Nematodes 108
Heterodera radicicola 109

ILLUSTRATIONS

PAGE
*Frontispiece, Exhibit of State Entomologist Office, Arizona State Fair, Phoenix
*PLATE I. Safeguarding Arizona's Vineyards 31
PLATE II. Date Palm Trees Before and After Treatment (Skinner) *Contraband Cotton Sacks Intercepted by Road Inspectors 42
*PLATE III. Arizona's First Vacuum Fumigator, Yuma, Ariz. Contraband Shipment of Sweet Potato Plants 46
PLATE IV. Map Showing Results of Apiary Inspection 48
*PLATE V. Apiary Exhibit, Arizona State Fair, Phoenix 51
Deloyala clavata 65
PLATE VI. Life Stages of the Cottonwood Leaf Moth (*Proleucoptera albella* Cham.) 70
PLATE VII. Types of Citrus Fruit Affected by *Myelois venipars* Dyar (Original) 80
PLATE VIII. 1. Injured Grape Fruit showing eggs of *M. venipars* in region of injury (Original). 2. Orange punctured by Gila Woodpecker, showing eggs in vicinity of injury (Original) 82
PLATE IX. Oranges partially decayed by Black Rot (*Alternaria citri*) (Original) 83
PLATE X. Life History of Myelois venipars 86
PLATE XI. Drawings showing morphological structures of *Myelois venipars* 90
PLATE XII. 1. Psorosis or Scaly Bark on Citrus Tree (Original) 2. Brown Rot Gummosis on Citrus Tree (Original) 103

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*Photographs by Commercial photographers. Drawings by Perry A. Glick.

LETTER OF TRANSMITTAL

Phoenix, Arizona, February 1, 1923.

To His Excellency, George W. P. Hunt,
Governor of Arizona.

My dear Sir:

In accordance with the provisions of the Arizona Crop Pest Law, we submit the Fourteenth Annual report of the Arizona Commission of Agriculture and Horticulture for the year ending June 30th, 1922.

Very respectfully,

Dr. T. S. Bishop, Scottsdale,
Chairman.
Sern Sorenson, Lehi,
Member.
Mrs. Inez H. Lee, Thatcher
Member.

PART I.

ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE

REPORT OF SECRETARY
For fiscal year ending June 30, 1922.

PERSONNEL OF COMMISSION

During the fiscal year ending June 30, 1922.
E. W. Hudson, Tempe, Arizona, Chairman.
Andrew Kimball, Thatcher, Arizona, Member.
A. Y. Greer, Yuma, Arizona, Member.
W. H. Robinson, Chandler, Arizona, Secretary.
Succeeded at reorganization of Commission, January 17th, 1923, by the following:
Dr. T. S. Bishop, Scottsdale, Arizona, Chairman.
Sern Sorenson, Lehi, Arizona, Member.
Mrs. Inez H. Lee, Thatcher, Arizona, Member.
D. C. George, Phoenix, Arizona, Secretary.

STATE ENTOMOLOGIST

During the fiscal year ending June 30th, 1922:
Don C. Mote.

Succeeded at reorganization of Commission, January 17th, 1923:
by Dr. Oscar C. Bartlett.

Following a custom found expedient in writing earlier reports of the Arizona Commission of Agriculture and Horticulture, while this report will cover the official acts for the fiscal year ending June 30th, 1922, there will be added matters covering the crop year ending December 31st, 1922, and a mention of the reorganization of the Commission under the administration of Governor George W. P. Hunt, January 17th, 1923.

At the beginning of the report, it may perhaps be well to note that the work of this Commission covers only a part of the aid Arizona endeavors to give its farming interests, other activities to that end, including the work of the State Agricultural college, experimental stations and farm advisers. Also the Federal Horticultural Board has been of material service to Arizona in cooperating in the work done by the State's agricultural staff of scientific employees.

The activities of this Commission consists largely in efforts to keep insects and diseases dangerous to plant life from entering the State. To this end it makes and enforces regulations prohibiting the importation from infected localities certain seeds, plants and nursery stock; also including, in certain instances, commodities that might be carriers for plant diseases or insects.

In the enforcement of these regulations not only are incoming express, mail and freight shipments examined, but also inspectors are kept on certain interstate highways to examine automobiles and other vehicles for contraband articles, coming from such infested points as the pink bollworm section of Texas.

Under the present law, the Commission consists of three members, appointed by the governor for a term of five years each, one of whom it elects as its chairman. It also appoints a secretary who keeps the minutes, attests all claims for debts incurred, attends to certain correspondence, etc.

The administration of the crop pest law, under this Commission, devolves upon the State Entomologist, who is also appointed by the Commission, and who, in custom, appoints his subordinates, subject to the approval of the Commission.

OFFICIAL ACTS OF THE COMMISSION

During the fiscal year ending June 30th, 1922, six meetings were held as follows:

(1) Meeting held at Tempe, Sept. 30th, 1921.

Present: E. W. Hudson, chairman; Andrew Kimball, member; D. C. Mote, State Entomologist and W. H. Robinson, secretary.

Mr. Kimball made a verbal report of his participation in the taxpayers' meeting at Nogales.

The Secretary and State Entomologist reported on the financial condition of the work. Suggestions were discussed to reduce expenses.

(2) Meeting held in Phoenix, October 21, 1921.

Present: Chairman E. W. Hudson, Member A. Y. Greer, State Entomologist D. C. Mote, and Secretary W. H. Robinson.

State Entomologist made a report of proposed reductions in salaries which would go into effect November 1, 1921.

Also he made a report on the work being done in investigating the orange moth, which was reported to be damaging the fruit of the naval orange trees in the Salt River Valley.

Motion passed that three of the automobiles now in service of the Commission be sold.

Permission granted to bring into Arizona from California a certain lot of cotton seed, under certain conditions.

State Entomologist made a report upon the inspection of incoming automobiles on the southeast borders of the State. Out of 631 cars examined at Bowie four were found to contain contrabrand articles.

He also made a report concerning the work of cleaning up volunteer fields of cotton in the non-cotton zone in the Tucson district. He reported that one live Thurberia cotton boll weevil had been found in a field of domestic cotton, and that the work of cleaning up the fields was being pushed rapidly. Where the owner or tenant could not be induced to do the work, it was being done by forces under the local inspector.

State Entomologist suggested that where practicable that citrus bud wood, grape cuttings, etc., suspected with being infested with insects or scales, be fumigated in a vacuum and inspected and certified before being allowed to be shipped into the State.

Requests that grain from Utah and apples from Idaho be allowed to be shipped into Arizona was denied on account of danger from alfalfa weevil.

Quarantine regulations regarding the importation of date palm, and date palm offshoots passed.

Also regulation passed requiring that all future plantings of citrus trees and seeds be recorded in the office of the State Entomologist.

(3) Meeting held at Phoenix, December 17, 1921.

Present: Chairman E. W. Hudson, Members A. Y. Greer and Andrew Kimball; Secretary W. H. Robinson, and State Entomologist, D. C. Mote.

Agreed that the activities of this Commission should be planned so there would be no duplication of labor between it and the experiment stations and other branches of State Agricultural work.

Agree that expense accounts of employees and commissioners should be kept at a minimum. In case of Commissioners the only expenses permissible would be those necessitated by travel and for room and meals covering shortest time in which it was reasonably possible to make the trip from Commissioner's residence to meeting place and return.

In response to a suggestion from Governor Campbell that the expenditures of this department be reduced $7,500.00, the Commission went carefully into a budget prepared by the State Entomologist, and Secretary, and decided that it would not only be impossible to make the reductions, but that it would take the utmost economy to do the necessary work with the appropriation placed at its disposal by the last legislature, viz.: $50,000.00.

(4) Meeting held at Phoenix, February 7th, 1922.

Present: Chairman E. W. Hudson, Member A. Y. Greer, State Entomologist D. C. Mote, and Secretary W. H. Robinson. Also Attorney General Galbraith sat in consultation with the Commission.

In order to simplify referring to regulations in case of law suits and other legal procedure, the attorney general suggested that all of the present regulations of the Commission, some of which had been several times amended, be reinacted, and the State Entomologist was instructed to have such regulations in form so they could be passed upon at the next meeting.

The increasing danger to alfalfa fields in Arizona from the alfalfa weevil, whose area of infestation in Utah, Nevada, Idaho, Wyoming, Colorado and Oregon is steadily growing, was discussed, and the State Entomologist was instructed, if funds permitted, to strengthen the work of inspection against that pest on the north and west borders of the State.

Responding to a request from Commissioner Kimball the

State Entomologist was instructed to send one of his men to Graham County to investigate the infestation of apple and other trees by damaging insects and diseases, and suggest remedies.

Letter read from H. M. Cely, Federal Plant Quarantine Inspector at Nogales, suggesting that the Commission keep a man at Nogales to inspect freight car shipments, as some freight cars there had been found to contain cotton seed sweepings that may have come from infested points outside the State.

State Entomologist was instructed to try to arrange with Mr. Cely to have him employ a man from time to time when needed for this department, under his direction, at moderate expense.

Several communications were read from parties asking for permission to import cotton seed into Arizona, and State Entomologist was instructed to permit such importations only in such cases where shipping points and fumigation precautions taken, made it impossible, in his judgment, for such seed to be a carrier of disease or dangerous insect infestation.

Commission authorized the purchase by D. C. Mote of a Dodge car at State appraised valuation.

(5) Meeting held in Phoenix, May 20th, 1922.

Present: Chairman E. W. Hudson, Member A. Y. Greer, Secretary W. H. Robinson, and State Entomologist Don C. Mote.

Senator A. J. Eddy, of Yuma, called upon the Commissioners and stated that a number of orchardists of the Yuma Valley mesa were considering planting orange trees but had discovered that the available orange nursery stock in Arizona was wholly inadequate in quantity and poor in quality, and asked that the present embargo against importing citrus nursery stock from California be lifted temporarily, so far as it effected the Yuma district.

M. B. Carpenter and W. J. Murphy made a similar request in behalf of certain orchardists in the Salt River Valley.

Discussion brought out the fact that California plant quarantine officials had been making experiments with vacuum fumigators on citrus nursery stock, and the State Entomologist was instructed to investigate the process and see if nursery stock so treated could, in his opinion, be safely brought into the State from California.

Commissioner Greer stated that Inspector Todd at Yuma had more work than he could attend to, and suggested that he be given an assistant. Motion carried that Todd be given such assistance as was compatable with local needs and the present necessity for economy.

State Entomologist made a report on condition of San Jose scale on apple trees in Graham County. He said that most of the orchards were small; that owners for the most part were not spraying, and that a campaign to make them spray would cost money. That if the Commission would try to compel all deciduous orchardists throughout the State to spray when the trees needed it, it would take more money than the Commission had to devote to such a purpose, or that would be left after doing more urgent work. That under present conditions, it seemed to him about all the Commission could do would be to show communities how to spray, teach them the danger of not spraying, and leave the different sections to locally undertake the financial part of seeing the work done.

State Entomologist was directed to employ a man to cover the inspection work at Nogales, consistent with the present need for economy.

It was agreed that in employing field scouts for the summer's work that experienced men be paid $125.00 a month, they to pay all their own expenses except transportation.

Resolution passed that the State Entomologist purchase three new Ford cars; turning in three old ones in part payment, subject to approval of Chairman Hudson.

State Entomologist was instructed to attend meeting of the Western Plant Quarantine Board at Sacramento, California.

Regulations with titles as follows were passed and approved, following the advice of the Attorney General:

Quarantine Order Number 1: Alfalfa Weevil.
Quarantine Order Number 3: Mexican Orange Maggot.
Quarantine Order Number 4: Grape Phylloxera.
Quarantine Order Number 12: Olive.
Quarantine Order Number 13: Citrus.
Quarantine Order Number 14: Sweet Potato Weevil.
Quarantine Order Number 15: Cotton Boll Weevil and Pink Bollworm

Quarantine Order Number 16: Peach Yellows.
Quarantine Order Number 17: Date Palm.
Quarantine Order Number 18: Sugar Cane.
Quarantine Order Number 19: Strawberry Root Weevil.

(6) Meeting held at Phoenix June 30th, 1922.

Present: Chairman E. W. Hudson, Members A. Y. Greer and Andrew Kimball; Secretary W. H. Robinson, and State Entomologist Don C. Mote.

A petition signed by fifteen bee men was read asking that J. T. Lisonbee be appointed inspector.

Discussion developed the fact that no funds other than the regular appropriation for plant quarantine work was at the disposal of the Commission, and but one thousand dollars had been set aside in the budget for apiary work.

State Entomologist stated that the only manner in which adequate service could be given the bee industry with the funds available was to have inspection work done by different plant quarantine inspectors, who could attend to the bee inspection in connection with their other work.

George M. Hill, representing the Yuma citrus growers appeared before the Commission and requested, as had been done at a previous meeting by Senator Eddy, that the present embargo against importing citrus nursery stock from California be temporarily lifted so far as it effected the Yuma district.

Alex. Brodie and Mr. Carpenter made a similar request regarding the Salt River Valley, but not claiming to represent any one but themselves.

Matter taken under advisement.

Meeting adjourned until 1:30 when it reconvened with all commissioners, state entomologist, and secretary.

Commission proceeded to reorganize for the fiscal year beginning July 1, 1922.

Upon resolution E. W. Hudson was reelected chairman; W. H. Robinson was elected secretary at an annual salary of $600.00 for the year.

Don C. Mote was reelected as State Entomologist at a salary of $3600.00 a year.

The following scientific staff, office force and inspectors were also appointed at salaries as stated:

Oscar C. Bartlett, Field Entomologist	$2700.00
J. H. O'Dell, Asst. Entomologist (Orange Pest)	1800.00
D. C. George, Plant Pathologist	2400.00
Frank E. Todd, Inspector, Yuma	2000.00
Harold S. Hensley, Inspector, Tucson	1800.00
Utilis Russell, Inspector, Salt River Valley	1400.00
Miss Elizabeth C. Mower, Asst. Secty. and Stenographer	1800.00
Miss Emily M. Williams, Office Clerk	1200.00

DISTRICT INSPECTORS

(To receive, except where otherwise indicated, seventy-five cents per hour when working.)

DISTRICT NO. 1:

J. A. Billingsley	Clifton
W. E. McBride	Pima
Howard J. Rice	Safford

DISTRICT NO. 2:

Note E. Guild	Florence

DISTRICT NO. 3:

Haywood A. Short	Parker

DISTRICT NO. 4:

A. Cruickshank	Prescott
J. W. Gerritt	Kingman
F. A. Chisholm	Flagstaff
Chas. D. Willard	Cottonwood

DISTRICT NO. 5:

O. C. Williams	Holbrook
D. W. Rogers	St. Johns
J. H. Hansen	Lakeside
W. B. Eagar	Eagar

DISTRICT NO. 6:

J. J. Hutchinson	Bowie	$600.00 per annum
E. Jahn	Douglas	
T. J. Weese	Cochise	
Jas. C. Hancock	Snowflake	

ROAD INSPECTORS:

E. Montague	Lordsburg, N. M.	$1200.00 per annum
H. B. Lovett	Duncan	600.00 per annum
I. C. Sorells	Blythe	
F. W. Officer	Rodeo, N. M.	

FIELD SCOUTS:

Roy W. Nixon	Tucson	$125.00 per month
R. S. Hawkins	Phoenix	125.00 per month
Richard F. Jones	Phoenix	100.00 per month

APIARY INSPECTOR:

L. Earl Matteson..........St. David

DATE PALM INSPECTOR:

H. B. Skinner................Tempe..... ....$5.00 per day, half to be paid by Federal Horticultural Board.

State Entomologist instructed to turn in Ford car for Yuma Inspector on a new one, and also buy a new Ford for Field Scouts. Also instructed to buy a small fire-proof safe for Phoenix office.

On account of danger from alfalfa weevil, request denied J. F. Barker Produce Co., Phoenix, to import apples from Idaho.

Secretary instructed to send an invitation to Chas. A. Park, Salem, Oregon, Chairman of the Western Plant Quarantine Board, inviting that body to hold its next annual meeting in Phoenix, and suggesting that such meeting be held early in May.

State Entomologist made a verbal report of his attendance at the meeting of the Western States Agricultural Representatives at Sacramento, May 29th and 30th, and also of the meeting held at Riverside June 27th, the latter to consider, among other things, possible changes in the California plant quarantine regulations concerning shipments of cotton and cotton products from Arizona to California.

During the afternoon, about eighteen Salt River Valley orange growers appeared before the Commission, and all but two, put themselves on record as being opposed to having the present embargo against shipping citrus nursery stock into the Salt River Valley from California, modified; many of them stating that, even though the danger of introducing damaging insects might be reduced to a minimum by vacuum fumigation, that they felt it unwise for the Salt River Valley growers to take any risk no matter how slight.

The Commissioners decided to hold their decision in the matter in abeyance until more of the local citrus growers could be heard from, and called a mass meeting of all the Citrus growers of the Salt River Valley for July 6th.

Later G. M. Hill, of Yuma, again appeared before the Commission and renewed his request that California citrus nursery stock be permitted to be shipped into the Yuma district, pointing out that conditions there were different from what they were in the Salt River Valley. They had but a few citrus trees planted there now, that many land owners wanted to plant, and they could not obtain trees in Arizona.

Resolution passed authorizing the State Entomologist to permit a special importation of citrus nursery stock into the Yuma district for the next season's planting, provided the sentiment of the Yuma growers should be practically unanimous in favor of such permission, such action to be concurred with by Commissioners Hudson and Greer.

It was also provided that if such importations should be allowed, they could only come in under special permits in each case, and after adequate safeguards had been observed, such as vacuum fumigation and close inspection.

MEMORANDUM:

At the mass meeting called in Phoenix for July 6th the sentiment against lifting the embargo on importing California nursery stock was so strong that the Commission decided to make no change in the present regulations so far as it effected the Salt River Valley.

On the other hand, investigations showed that the Yuma district seemed unanimously in favor of allowing California nursery stock to be shipped into that district, and such permismission was granted, and Quarantine No. 13 was amended to that effect, stating conditions under which such nursery stock could be brought in. Such action being ratified by the Commission by unanimous vote at a full meeting of the Commission, November 2nd, 1922.

The matter of the danger of introducing by freight cars into Arizona, insects damaging to crops, has many times been considered by this Commission. Cars loaded with freight in regions infested with alfalfa weevil, cotton boll weevil, pink bollworm, etc., are shipped all over the country. Some of these cars contain litter, straw, hay or some other substance that might afford hiding places for insects. Some of these cars naturally find their way into Arizona. This Commission, as have the agricultural departments of other states, the Western Plant Quarantine Board and other bodies, has petitioned the railroads, and the commissioners have conferred with their officials, trying to induce the railroads to fumigate all cars in danger of carrying such insect contamination.

The railroads, however, have always taken the attitude that such fumigation of cars is impracticable except in certain extreme cases. Cars carrying cottonseed, known to be infected, are afterwards fumigated; but this is only done under special circumstances and where the special insect to be guarded against is specified.

This Commission feels that this condition leaves a broad avenue open by which damaging insects might easily enter Arizona, and it believes that efforts, with the cooperation of other states and with such agencies as the Federal Horticultural Board and the Western Plant Quarantine Board, to the remedying of this condition should be continuously prosecuted.

W. H. ROBINSON, Secretary.

ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE

FINANCIAL REPORT

for fiscal year ending June 30, 1922.

Salaries and Wages:

Three Commissioners			$ 900.00	
Secretary			520.00	
State Entomologist			3,700.00	
Field Entomologist			2,800.00	
Plant Pathologist			2,400.00	
Entomologist (Orange Pest)			750.00	$11,070.00
Stenographer			$1,800.00	
Clerk			1,050.00	2,850.00
Quarantine Inspectors:	Tucson		$1,800.00	
	Safford		225.00	
	Yuma		2,000.00	4,025.00
Crop Pest Inspectors:	Phoenix		$1,400.00	
	Clifton	$ 70.00		
	Pima	70.00		
	Duncan	64.00		
	Safford	10.00		
	Casa Grande	273.00		
	Florence	25.00		
	Parker	49.00		
	Prescott	169.00		
	Kingman	199.00		
	Flagstaff	48.00		
	Cottonwood	20.00		
	Holbrook	96.00		
	St. Johns	40.00		
	Lakeside	30.00		
	Taylor	48.00		
	Eagar	52.00		
	Snowflake	48.00		
	Douglas	142.00		
	Cochise	48.00		
	Paradise	48.00	1,549.00	2,949.00
Road Inspectors:	Bowie	$ 654.00		
	Rodeo	175.00		
	Lordsburg	1,200.00		
	Duncan	325.00		
	Apache	36.00		
	Blythe	73.00		2,463.00

ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE

FINANCIAL REPORT—Continued

SALARIES AND WAGES—Continued.		
Field Scouts	$3,404.00	
Apiary Work	588.00	
Date Palm Work	484.00	
Miscellaneous	305.21	4,781.21
TOTAL		$28,138.21
OPERATION:		
Printing and publications	$ 253.37	
Office expense	1,785.05	
Postage and box	177.25	
Express and drayage	139.92	
Telephone and telegraph	432.64	
Insurance and bonds	276.52	
Automobiles	3,950.69	
Laboratory and field	423.23	7,438.67
TRAVEL:		
Commission and scientific staff	$1,920.86	
Inspectors and Scouts	2,174.26	4,095.12
CAPITAL INVESTMENT:		
Automobiles	$1,895.79	
Office	1,003.03	
Laboratory and field	2,312.90	
Books and Periodicals	507.06	5,718.78
REPAIRS AND REPLACEMENTS:		
Automobiles	$ 600.62	
Office	34.00	
Laboratory and field	294.50	
Book binding	114.80	1,043.92
TOTAL		$46,434.70

ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE

RECEIPTS AND EXPENDITURES
for fiscal year ending June 30, 1922.

APPROPRIATION	$50,000.00	
Less Cotton Growers'	2,500.00	$47,500.00
Sale of Car No. 49		175.00
Salary Refund		18.17
Balance cotton fund		266.32
Sale of Car No. 32		275.00
Canteen (Car No. 29)		6.50
Sale of Car No. 21 (Part payment)		200.00
Sale of Car No. 20		125.00
Claims put in too late for payment:		
F. W. Officer	$ 50.00	
F. W. Officer	50.00	
J. J. Hutchinson	27.00	127.00
TOTAL RECEIPTS		$48,692.99
TOTAL EXPENDITURES		46,434.70
Returned to State Auditor		$ 2,258.29

PART II.

ANNUAL REPORT

LETTER OF TRANSMITTAL

To the Arizona Commission of Agriculture
and Horticulture,

Phoenix, Arizona.

Sirs:

I submit herewith the Fourteenth Annual Report of the work of the State Entomologist's office, for the fiscal year ending June 30, 1922, with a supplementary report covering the activities of the department for the full calendar year of 1922.

Respectfully,

Don C. Mote,
State Entomologist.

LINES OF WORK

1. The general administration and enforcement of the Arizona Crop Pest Law; the quarantine orders, rules and regulations of the Arizona Commission of Agriculture and Horticulture.

2. The general administration and enforcement of the Bee Disease Eradication Law; the quarantine orders, rules and regulations of the Arizona Commission of Agriculture and Horticulture thereunder.

3. The general administration and enforcement of the Arizona Pure Seed Law.

4. The regulation of the entry of foreign cotton seed and other seed, used gin machinery, cotton bagging, household goods, farm implements and livestock from infested states.

5. The regulation of the entry of bees, hives, apiary materials and supplies.

6. The regulation of the entry of nursery stock and other plant and plant products for propagation.

7. The railway, postal and road inspection service maintained by the Commission as an essential part of the enforcement of the laws, quarantine orders, rules and regulations.

8. Inspection of Arizona nurseries.

9. Field and Orchard Inspection service.

10. Control and eradication of destructive plant enemies.

11. Apiary inspection and eradication of American foul-brood.

12. Insect pest and plant disease survey.

The work of the office during the past year has been carried on with the following organizations:

Insect and Plant Diseases Control—Deciduous Fruits, Potatoes and Citrus Thrips—Dr. Oscar C. Bartlett, Field Entomologist.

Crop Diseases, Survey and Collections, Pathological Inspector D. C. George, Plant Pathologist.

District Entomologist and Inspector, Yuma—F. E. Todd, Assistant Entomologist.

District Entomologist and Inspector, Tucson—J. H. O'Dell, Assistant Entomologist (Chief Deputy Crop Pest Inspector, beginning July 1, 1922).

Crop Insects, Survey and Collections—Perry A. Glick, Assistant Entomologist (beginning October 1, 1922).

Plant Inspections and Quarantine Work—H. S. Hensley, Chief Deputy Crop Pest Inspector (resigned July 1, 1922).

Apiary Inspector—R. F. Jones.

Date Palm Inspector—H. B. Skinner (beginning February, 1922).

Crop Pest Inspector, Phoenix—Utilis Russell.

Field Scouts—

R. F. Jones, R. S. Hawkins (July and August).
Roy W. Nixon (July-September 15).
J. C. Robinson (July-December 1).

Local Inspectors and Road Inspectors:

(A list of these men can be found on page 18.)

PLANT QUARANTINE INSPECTION SERVICE

The Plant Quarantine and Inspection service safeguards the Agricultural Industry of Arizona from pest invasion and insures the planting by farmers, and fruit growers of trees and plants free from dangerous pests. In this connection, it is a pleasure to report that no instance has come to light of any serious insect pest or plant disease being distributed upon trees and plants inspected and passed by the Commission's inspectors and no serious pest or disease is known to have gained entry into Arizona and become established during the past year.

Inspection of Shipments of Nursery Stock, Fruit and Other Plant Products.

During the period from July 1, 1921, to June 30, 1922, and July 1, 1922, to December 31, 1922, a total of 4,791 and 965 shipments, respectively, were inspected by Arizona Inspectors. (July and August 1921 reports were lost in the flood of August 1921.)

Table No. 1

District No.	Counties included in District	Total Shipments 1921-22	Inspected July, 1922, to Dec. 31, 1922
1	Greenlee, Graham and Gila	165	14
2	Maricopa and Pinal	1882	554
3	Yuma	760	209
4	Yavapai, Mohave and Coconino	695	135
5	Navajo and Apache	169	3
6	Cochise	591	66
7	Pima and Santa Cruz	529	65
	TOTALS	4791	1046

From the shipments of 1921–22, 210 shipments or slightly more than 4 per cent of the total were condemned as a whole or in part by Arizona inspectors.

From July to December 31, 1922, 83 shipments were condemned as a whole or in part.

Forty-six shipments were treated and released in 1921–22.

Four shipments were treated and released during the period m July 1 to December 31, 1922.

Table No. 2

DISPOSAL OF SHIPMENTS	1921-22	July 1 to Dec. 31, 1922
Released	4535	959
Treated and released	46	4
Portion of shipment released	92	34
Entire shipment condemned	118	49
TOTALS	4791	1046

One hundred and five shipments of various kinds were condemned on account of quarantines in 1921–22. These included ten violations of the Alfalfa weevil quarantine; five violations of the grape phylloxera quarantine; three violations of the olive quarantine; twenty-four violations of the citrus quarantine; seven violations of the sweet potato weevil quarantine; twenty-eight violations of the cotton boll weevil quarantine*; thirteen violations of the peach yellows quarantine; two violations of the date palm scale quarantine; one violation of the Federal corn borer quarantine; two violations of the Federal white pine blister rust quarantine; eight violations of the Federal sugar cane quarantine; two violations of the Federal Japanese beetle quarantine.

Thirty-three shipments of various kinds were condemned on account of quarantines during the period from July 1, to December 31, 1922. These included: One violation of the Alfalfa weevil quarantine; thirteen violations of the citrus quarantine; six violations of the sweet potato weevil quarantine; twelve violations of the cotton seed quarantine*; one violation of the peach yellows quarantine.

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*These figures do not include the contraband material intercepted in the inspection of luggage of Auto tourists and immigrants. (See page 36.)

Table No. 3

Miscellaneous Importations Inspected July 1, 1921, to December 31, 1922

Variety	Scions	Cuttings	Seeds or Pits	Budwood	Offshoots	Fruit & Vegetables
Date Palm	....	....	....	....	950	....
Citrus	....	....	2 sacks	7176	....	4 carloads & 11,789 boxes
Grape	....	1,564,593	....	....	....	341
Apple	102	....	....	....	....	150
Pear	2	....	....	....	....	5726 pounds
Potatoes	....	....	....	....	....	19 carloads & 974 sacks
Peach	....	....	625 pounds	....	....	1 box
Fig	....	5235	....	....	....	978 boxes
Tamarix	....	3759	....	....	....	
Berry	....	124	....	....	....	
Mulberry	....	4	....	....	....	
Pineapple	....	....	....	....	95	
Pecan and Miscellaneous Nuts	250	....				
Walnut	90	....				
Rose	....	1 box				
Elderberry	12					
Cherry	2					

Ornamentals 5 bales
Flowers, etc. 46,640
Miscel. Plants 1,496
Household Goods—Alfalfa weevil districts 39
Household Goods—Cotton boll weevil districts 262
Cotton machinery 58

Table No. 4
Fruit Tree Inspections

	1921-22	July 1 to Dec. 31, 1922
Berry	69,730	128,929
Ornamentals	64,048	7,319
Grape	63,742	10,058
Peach	29,667	4,206
Plum	12,434	396
Apple	7,833	1,616
Apricot	6,076	170
Pear	3,924	308
Mulberry	2,236	16
Fig	1,669	106
Pecan	1,524	443
Quince	1,337	16
Prune	890	....
Almond	720	2
Cherry	410	59
Walnut	368	7
Persimmon	276	1
Currants	258	....
Date Palms	165	....
Pomegranate	158	....
Nectarine	152	....
Olive	53	....
Hazelnut	18	....
Butternut	10	....
Pistachio	9	....
Filbert	8	....
Chestnut	7	....
Guava	4	2
Avocado	3	....

Parcel Post Shipments

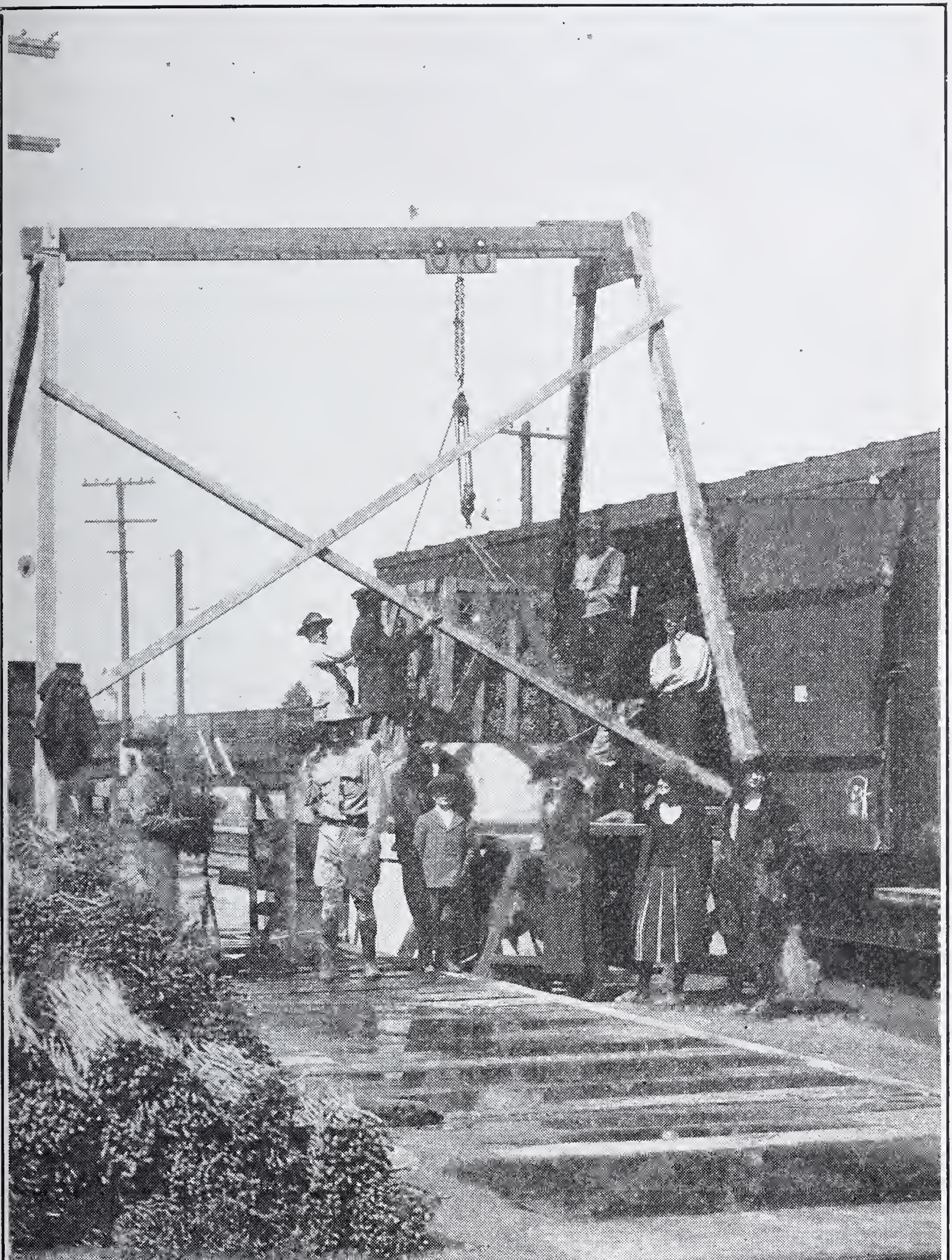
There were 1,731 parcel post shipments inspected by Arizona inspectors during 1921–22, and 210 during the period between July 1 and December 31, 1922. Of the former number 1,688 were released, 9 were treated and released, 11 released in part and 23 condemned.

During the period between July 1, and December 31, 1922, 202 were released, 2 were treated and passed, 3 released in part and 3 condemned.

Pests Intercepted

The list of pests intercepted by Arizona inspectors in shipments of plants and other inspected materials is given in Table 5.

One of the notable interceptions of the year is the cotton boll



SAFEGUARDING ARIZONA'S VINEYARDS
863,000 grape cuttings being dipped, Yuma, Arizona

weevil, a live specimen of which was found in a lot of souvenir cotton bolls being carried by automobile tourists in a car bearing a Minnesota license. (Table No. 6.)

The insect pests most frequently intercepted were the scale insects which attack citrus trees. These were found mostly on citrus fruits. The disease most frequently met with was crown gall.

Nursery Inspection

In order to prevent the introduction of injurious pests on nursery stock shipped into the State and to prevent the distribution on nursery stock of injurious insects and diseases within the State, the inspection of the following nurseries and plant propagators constitutes one of the duties of the office.

BOWIE, ARIZONA:
- Ray Reed

TUCSON:
- Monthan Bros.
- Langers Seed & Floral Co.
- Chas. Brossart

CASA GRANDE:
- Chas. B. Davis

MESA
- Mesa Seed & Feed Co.

PHOENIX:
- Tice Rose Gardens
- A. J. Keen, Ornamentals
- Phoenix Seed and Feed Co.
- Arizona Seed and Floral Co.
- Blasingame Nurseries
- Riverside Nurseries

PRESCOTT:
- J. S. Acker
- A. Cruickshank
- Geo. Allen

YUMA:
- Yuma Date Nursery
- Yuma Citrus Nursery
- Ruby Ranch—Sugar Cane and Plants
- Rice Citrus Nursery
- Pioneer Citrus Nursery
- Hamilton Bros. Nursery
- Delta Seed and Feed Co.
- Curl Citrus Nursery
- Bankers' Gardens

Table No. 5

Insect Pests and Plant Diseases brought into the State, by freight, express and mail shipments and discovered by Arizona inspectors.

1921 - 1922

NAME OF PEST OR DISEASE	HOST	TOTAL
Bulb Maggott (*Merodon equestris*)	Bulbs	1
Scale (undetermined)	Ferns	3
Scale (undetermined)	Cyclamen	1
Scale (undetermined)	Ornamental Plants	5
Scale (undetermined)	Roses	2
Scale (undetermined)	Blackberry	2
Crown gall (*Bacterium tumefaciens*)	Nursery Stock	40
Hairy Root (*Bacterium tumefaciens*)	Nursery Stock	5
Peach rosette	Peaches	2
Citrus scale (undetermined)	Citrus fruits	25
Red Scale (*Chrysomphalus aurantii*)	Citrus fruits	12
Purple Scale (*Lepidosaphes beckii*)	Citrus plants	3
Palm Scale (undetermined)	Ornamental palm	2
Mealy Bug (undetermined)	Fruits & Ornamentals	4
Aphis (undetermined)	Ornamental plants	4
Citrus Red Spider (*Tetranychus mytilaspidis*)	Citrus fruits	4
Peach Borer (*Sanninoidea exitiosa*)	Peach trees	5
San Jose Scale (*Aspidiotus perniciosus*)	Nursery Stock	1
Root Knot (*Heterodera radicicola*)	Nursery Stock	9
Carnation Rust (*Uromyces caryophllinus*)	Carnation	2
Black Rot (*Sphaeronema fimbriatum*)	Sweet Potatoes	1
Stem Rot (*Fusarium* Sp.)	Sweet Potatoes	1
Fungus Disease	Ornamentals	1
The Two Spotted Mite (*Tetranychus telarius*)	Ornamentals	1

Table No. 6

Insect Pests and Plant Diseases brought into the State, by freight, express and mail shipments and discovered by Arizona inspectors.

July 1st to December 31st, 1922

NAME OF PEST OR DISEASE	STATE	HOST	TOTAL
Citrus Scale (undetermined)	Calif.	Citrus fruits	33
Citrus Scale (undetermined)	Texas	Limes	3
Citrus Scale (undetermined)	Mexico	Limes	2
Red Spider	Calif.	Lemons	1
Argentine Ants	Calif.	Limes	1
Mealy Bug (undetermined)	Hawaii	Pineapple	2
Scale (undetermined)	Hawaii	Pineapple	2
Scale (undetermined)	Calif.	Ornamentals	4

White Fly (undetermined)	Calif.	Ornamentals	1
Aphis (undetermined)	Calif.	Ornamentals	1
Fern Scale (undetermined)	Illinois	Fern	2
Mealy Bug (undetermined)	Arkansas	Cape Jasamine	1
Root Knot (*Heterodera radicicola*)	Iowa	Apple	1
Crown Gall (*Bacterium tumefaciens*)	Texas	Apple, Peach, Apricot	3
Crown Gall (*B. tumefaciens*)	Calif.	Grape	1
Crown Gall (*B. tumefaciens*)	Iowa	Raspberry, Dewberry	1
Borer (undetermined)	Texas	Plum	1
Boll Weevil Larva (*Anthonomus grandis*)		Cotton bolls	1

Sources of Plant Shipments

During the past year plant shipments came from 32 states, 3 foreign countries and over 125 different shippers. Forty-three nurseries made ten or more shipments each, as shown by Table No. 1.

Table No. 7

List of Nurserymen sending ten or more shipments into Arizona.

Results of Inspection:

		No. Condemned		Per Cent Condemned
Shipper	No. Shipments Inspected	As a Whole	In Part	As a Whole and in Part
Aggeler & Musser	65	..	..	-------
Arkansas Nurseries	18	5	3	44
Armacost Nurseries (W. & Co.)	91	..	..	-------
American Rose Company	37	..	..	-------
Armstrong's Nursery	315	..	8	2.5
Austin Nursery	81	..	6	7
Bureau of Plant Ind.	12	..	..	-------
Burton Seed Company	43	..	2	4.6
Burbanks Exp. Farm	11	..	..	-------
Baines, Ella V.	40	..	..	-------
Buckbee, H. W.	27	..	..	-------
Barteldes Nursery	38	2	..	5
California Nursery	22	..	1	4.5
Childs, John L.	27	..	1	3.7
Capper, Arthur	11	..	..	-------
Capital City	23	..	..	-------
Dingee & Conrad	18	1	..	5.5
Fancher Creek Nursery	45	..	3	6.6
Henry Field Seed	16	..	..	-------
Gage & Co., H. V.	16	..	..	-------
Garden City Nursery	20	..	..	-------

Germain Seed Co.	155	--	1	0.6
Good & Reese	12	--	--	-------
J. M. Good	21	--	--	-------
Great Northern Plant Co.	24	--	--	-------
Hills Nursery	38	--	--	-------
Howard & Smith	75	1	--	1.3
Howard Rose Co.	19	--	--	-------
Heller Bros.	20	--	--	-------
Kellogg	14	--	--	-------
Morris & Snow	63	--	--	------
McGreggor Bros.	19	--	--	-------
Neosho Nursery	29	--	--	-------
Orange County Nursery	19	--	--	-------
Pioneer Nursery	20	1	2	15
Superior Nursery	12	--	1	8
Storrs-Harrison	11	1	--	9
Stark Bros.	116	1	5	5
Southern California Rose Co.	63	1	--	1.5
Sonderegger Nursery	119	--	2	1.7
U. S. Dept. of Agriculture	27	--	--	-------
Vallance Nursery	11	--	--	-------
Willis Nursery	16	--	--	-------
Wagoner Nursery	14	--	--	-------

SAFEGUARDING COTTON CULTURES

Automobile a Factor in Spreading Pests and Plant Diseases

The inspection of automobiles, especially those carrying camping effects, is a very vital feature of plant quarantine enforcement. Numerous examples are on record of Mexican boll weevils, alfalfa weevils and other dangerous insects having been found in the effects of automobile travelers. A graphic example of the introduction and establishment of an insect pest was narrated by Mr. Chas. A. Park, Salem, Oregon, chairman of the Western Plant Quarantine Board, in his annual address at the Fourth Annual Convention in Sacramento, California. A representative of the Federal government who was making a soil survey in Multnomah County, Oregon, where the elm leaf beetle is prevalent, spent his week end at the Oregon Agricultural College, at Corvallis. In a group of elm trees at Corvallis, under which the man's automobile was parked over the week end, the elm leaf beetle made its appearance, which indicated that the beetle was carried from Multnomah County to this section in the automobile used by the man who was making the soil survey.

In order to prevent the introduction of pests by means of the automobile, the Commission established inspection stations on the roadways entering the state from boll weevil and pink bollworm infested districts. At Lordsburg the work has been conducted in cooperation with the Federal Horticultural Board. The results of the road inspection work emphasize the vital necessity of vigorously prosecuting this phase of plant quarantine enforcement.

During the past year and a half, from July 1, 1921, to December 31, 1922, the road inspectors at Lordsburg, New Mexico; Rodeo, New Mexico; Bowie, Duncan, Lees Ferry, and Ehrenburg, Arizona, inspected a total of 9,729 automobiles and other vehicles coming into the State of Arizona. In these conveyances were found 819 lots of contraband material consisting of cotton sacks, seed cotton, cotton seed, lint, cottonbolls, cotton stalks, mattresses and pillows stuffed with seed cotton, grape vines, date palms, fig trees, citrus fruit, apples and sweet potatoes. The cars carrying the contraband material bore licenses from the following states: Texas, Oklahoma, New Mexico, Arkansas, Georgia, Kansas, Missouri, Tennessee, Indiana, Iowa, Illinois, Ohio, Michigan, Wisconsin, Colorado, Minnesota, North Dakota, South Dakota, New York, Nebraska, Mississippi, California, Oregon, Rhode Island and Canada. Bolls of cotton showing the work of the boll weevil were found in a car bearing a Kansas State License, and a live boll weevil larva was found in souvenir cotton bolls being carried by a Minnesota car.

The inspector at Tempe during the months of September, October and November inspected baggage belonging to 2,251 alien laborers brought in to pick cotton and destroy contraband material as follows:—17 pillows stuffed with seed cotton, 6 pickers sacks, 2 sacks seed cotton, one mattress made of seed cotton, 1 sack pomegranates, 1 sack calabazilla seed and 1 orange.

Inspection of Cotton Fields

by J. H. O'DELL

As an additional safeguard, and for the purpose of discovering initial infestation of insect pests and diseases, a necessary factor in combating dangerous plant enemies and preventing crop losses, inspection of the cotton fields is maintained throughout the growing and picking season. Predicated upon the results of this field inspection work is the movement of cotton seed and seed cotton from one planting district to another for ginning, milling or planting purposes.

This year the scouting extended over a period from July 7 to November 24. The work was started soon after the cotton began blooming and kept up until after the plants had been killed by frost.

Practically all the cotton growing sections in the State were covered as thoroughly as time and funds would permit. The sections covered were Salt River Valley, Yuma district, Florence and Casa Grande, Parker, Tucson, Gila Bend and Safford. The smaller sections required much more time per acre as the cotton was scattered over quite a large acreage. In the Salt River Valley at least one field in every section growing cotton was inspected.

Any insect or plant disease found doing damage to any part of the cotton plant was brought into the office for determination. No specimens of the most injurious cotton pests, the Mexican boll weevil and the Pink boll worm, were found in any section of the State. Several reports of the boll weevil from various sections of the State were investigated and, in each case, found to be species of non-injurious weevils or other insects.

In the non-cotton zone near Tucson considerable time was spent inspecting volunteer cotton plants for injury by the Arizona wild cotton weevil (*Anthonomus grandis thurberiae*), which was found attacking Pima cotton in that region in the summer of 1920. Every volunteer plant having bolls or squares was closely inspected but no evidence of injury discovered.

The sections scouted, the acreage covered and the time spent in field inspection is as follows:

Table 8

	Acres	Man Hours
Salt River Valley	13,719	746.5
Yuma	1,440	103.5
Florence and Casa Grande, Pinal Co.	461	14.5
Postvale, Pima Co.	775	79.5
Parker, Yuma Co.	399	26.5
Gila Bend	100	4.0
Safford, Graham Co.	100	....
	16,994	974.5
Tucson (1,537 volunteer plants)		80.0
Total Man Hours		1054.5

Table 9

Summary Inspection, Cotton Fields, 1920–22, inclusive

DISTRICT	1920 Man Days	 Inf. Fields	1921 Man Days	 Inf. Fields	1922 Man Days	 Inf. Fields
Salt River Valley	......	0	176	0	746.5	0
Yuma	......	0	66	0	103.5	0
Pinal Co.	......	0	8	0	14.5	0
Pima Co.	188	5*	72	2*	159.5	0
Parker, Yuma Co.	......	..	7	0	26.5	0
Safford, Graham Co.	......	0	1	0	....	0
San Simon, Cochise Co.	......	0	......	..	....	..
Gila Bend, Maricopa Co.	......	..	......	..	4.0	0
TOTAL	608†	5*	330	2*	1054.5	0

The Thurberia Boll Weevil.

The non-cotton zone promulgated and established by the Commission in 1921 on account of the Thurberia or Arizona wild cotton boll weevil was continued during the season of 1922 with the result that no cotton was planted in this region; however volunteer cotton was found in a few fields. This volunteer cotton was thoroughly scouted and then destroyed. No infestation of the weevil was found. A summary of the volunteer cotton inspection work in the non-cotton zone appears in Table 8.

In November 1922 the Commission was petitioned by the farmers residing in the township immediately east of Rillito station that they be permitted to raise cotton during the season of 1923. In response to this request a meeting was called at Rillito, December 7th, 1922, where E. W. Hudson, chairman, and Don C. Mote, State Entomologist met about seventy-five farmers and others interested, to discuss the matter.

The meeting was presided over by Mr. Mose Drachman, receiver of the Pima Farms Company. Both Mr. Hudson and Mr. Mote spoke of the danger of allowing any cotton to be planted in the non-cotton zone for the reason that the danger would be very great that it would become infested with the

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*Number fields in which the Thurberia or Arizona wild cotton boll weevil (*Anthonomous grandis thurberiae*), was found.

†Man days devoted to field inspection in various districts not available for 1920.

Thurberia cotton boll weevil, which would not only ruin the cotton industry in Pima County, but would, in all liklihood, spread from there throughout the entire State.

Mr. Hudson, in speaking, said that he was a farmer himself and appreciated just how much of a hardship it was upon the farmers who were not allowed to plant cotton, suggested that they try to get Dr. W. D. Hunter, of the Federal Horticultural Board, who had directed much of the fight against the cotton boll weevil and pink bollworm in the South, to come and make investigations in the Tucson district, and give his opinion on the matter of opening up any of the non-cotton zone. This suggestion was carried out and on December 20th, Mr. Hudson and Mr. Mote again went to Tucson where they met Dr. Hunter and R. E. McDonald, Chief Entomologist of Texas, and the four men drove over the entire district in question, making careful investigation. A meeting was held attended by farmers and Messrs. Hunter, McDonald, Hudson and Mote, at Congress Hotel. Both Dr. Hunter and Mr. McDonald stated that there would be grave danger of infestation from Thurberia boll weevil if any part of the present non-cotton zone would be opened to cotton. Mr. McDonald said, in his opinion, there was danger of infestation anywhere within seventy-five miles of where boll weevil might be found.

Afterwards Messrs. Hunter and McDonald wrote a letter as follows to Mr. Mote, State Entomologist:

(COPY)

Tucson, Arizona,
December 20, 1922.

Mr. Don C. Mote,
State Entomologist,
Phoenix, Arizona.

At the request of your Commission we have made a careful study of the wild cotton weevil situation in Arizona at the present time with special reference to the proposal which has been made that the non-cotton zone in Pima County be modified.

We regard the Thurberia weevil problem as one of great and immediate importance to the agricultural interests of Arizona and to other cotton producing states. The situation at the present time is very similar to that of the Mexican boll weevil of some 25 years ago, when it was restricted to a very small area in Southern Texas. The advance of the insect into the cotton belt and the enormous losses which have followed in its wake could have been prevented by the establishment of an adequate non-cotton zone.

There is now an opportunity to prevent the establishment of another destructive pest of cotton in the shape of the wild cotton weevil by means much more simple and economical than would have been possible in the case of the Mexican boll weevil.

In our opinion the responsibility of making use of the present opportunity rests with the Commission and with the farmers of the territory involved, who have uniformly shown an unusual spirit of hearty cooperation with the Commission, and have thereby rendered comparatively easy the solution of a problem which otherwise would have been much more difficult.

Compliance with the petition presented would in effect mean that the distance between cotton cultures and the Thurberia weevil in its natural habitat would be reduced. We do not think that the situation could be adequately met by any action other than continuing the quarantine zone as it is now established. We therefore recommend that no change be made in the non-cotton zone.

(Signed) W. D. HUNTER,
R. E. MCDONALD.

After receiving this report Chairman Hudson and State Entomologist Mote incorporated their findings in a report to the farmers of the Tucson district denying their request to allow cotton planting in any part of the present non-cotton zone.

Their report reads as follows:

The Arizona Commission of Agriculture and Horticulture has made a careful study of the wild cotton weevil situation in Arizona at the present time with special reference to the proposal which has been made that the non-cotton zone in Pima County be modified. In connection with this investigation the members of the Commission have had the council and advice of Dr. W. D. Hunter, of the Federal Horticultural Board, and R. E. McDonald, Chief Entomologist of Texas, who at the request of the Commission came to Tucson, December 20th, 1922, for the purpose of making a careful investigation of the wild cotton weevil situation.

These gentlemen concur with the Commission in the opinion that the wild cotton weevil problem is one of great and immediate importance to the agricultural interests of Arizona. The situation at the present time is very similar to that of the Mexican boll weevil of twenty-five years ago, which was restricted to a very small area in Southern Texas.

The advance of the Mexican boll weevil into the southeastern cotton belt and the enormous losses which would have followed its wake could have been prevented by the establishment of an adequate non-cotton zone.

There is now an opportunity to prevent the establishment of another cotton pest in the shape of the wild cotton weevil by a much more simple and economical means than would have been possible in the case of the Mexican boll weevil. The responsibility of making use of the present opportunity rests with the Commission of Agriculture and with the farmers of the territory involved, who have uniformly shown an unusual spirit of hearty cooperation with the Commission.

Compliance with the petition would, in effect, mean that the distance between the cotton zone and the wild cotton weevil in its native habitat would be reduced, and the danger of infestation increased. The Commission does not think that the situation can be adequately met by any action other than the continuation of the zone, as it is now established. They, therefore, have decided that no change be made in the non-cotton zone.

In this connection, it may be well to state that this action on the part of the Commission has been arrived at in an unbiased manner. It was with this end in view that the Federal and Texas experts were invited to confer with the State Agricultural Board.

Both the Commission and these experts have given much time to a fair and just consideration of the case of the grower who is affected by the non-cotton zone, and it is with deep regret that the interests of the cotton industry of Pima County and other parts of Arizona compel the Commission to maintain the present non-cotton zone.

(Signed) E. W. Hudson, Chairman,
Don C. Mote, State Entomologist.

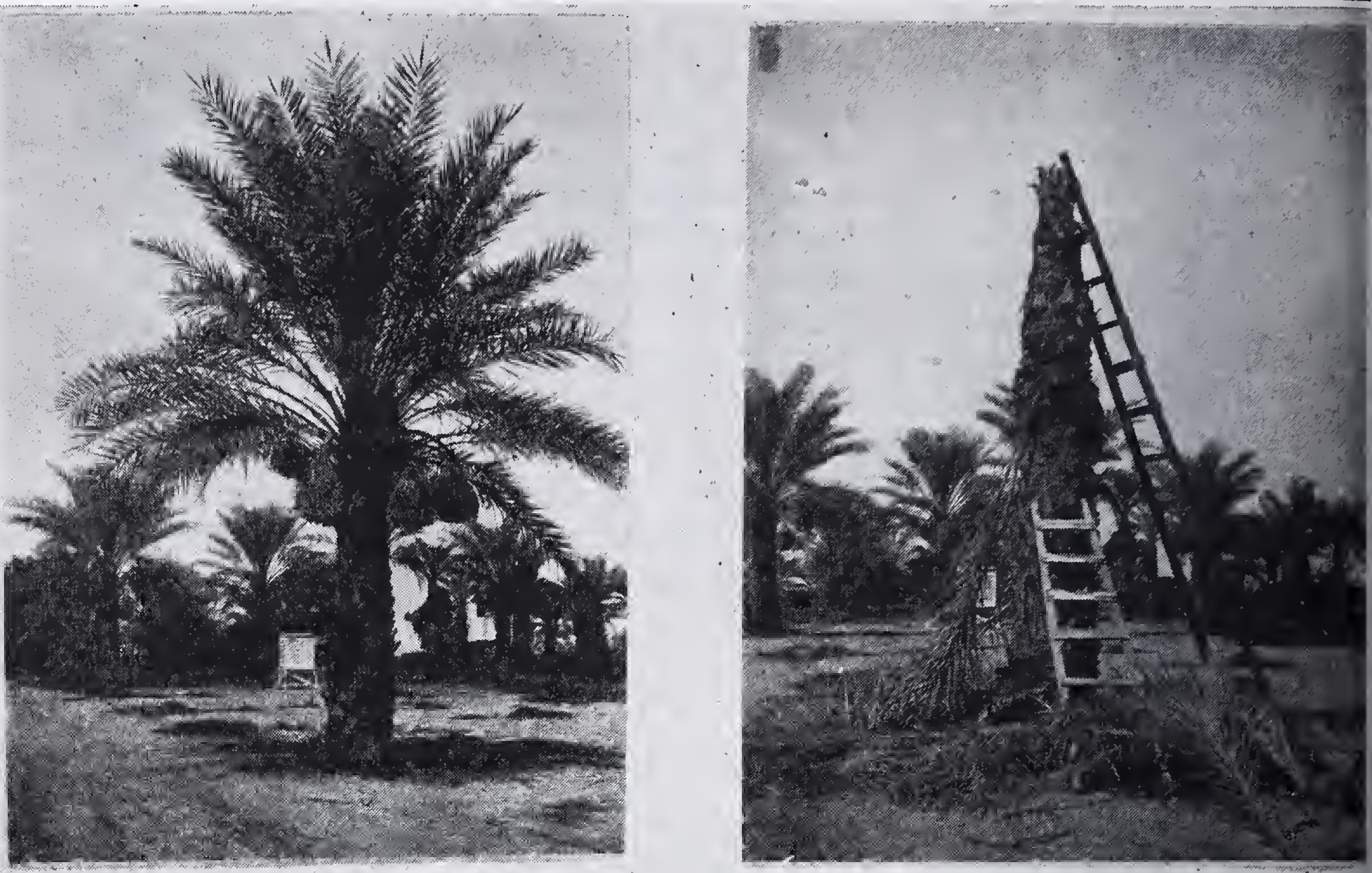
In accordance with this decision of the Commission the non-cotton zone order which had been in effect during the years of 1921 and 1922, was prepared and submitted to the Attorney General, Mr. John W. Murphy.

Prosecution for Violation of the Mexican Boll Weevil Quarantine

During the year 1922 information was filed with the Attorney General of a flagrant violation of the cotton boll weevil quarantine. By reason of the active support of the Yuma County Farm Bureau and valuable assistance of the Yuma County Attorney and Sheriff, the defendant, upon conviction was fined $100.00 and sentenced to six months in jail.

Cottonseed Importations from California Permitted

In concurrence with the aims of the Western Plant Quarantine Board and with a view to being of the utmost service to the producer, the Commission in November modified the cottonseed quarantine permitting the importation of seed grown in California provided the seed be subjected to vacuum fumigation. Under this arrangement it is believed, the growers will be enabled to get sufficient medium staple cottonseed to supply their needs for the growing season of 1923 under restrictions which will safeguard Arizona's cotton crop.



Above. DATE PALM TREES BEFORE AND AFTER TREATMENT
For eradication of scale (PARLATORIA BLANCHARDI)
Below. CONTRABAND COTTON SACKS INTERCEPTED BY ROAD INSPECTORS
Such material may carry the dreaded pink bollworm and Mexican boll weevil

THE CITRUS FRUIT AND NURSERY QUARANTINE

Automobile a Factor in Spread of Citrus Pests

In the last report the fact was mentioned that the increased popularity of the automobile for travel and touring and of the auto truck for transportation purposes, made it necessary to take these vehicles into consideration as possible carriers of plant products that might be infested with destructive pests. The Automobile inspection established by the Commission has fully substantiated this fact. Citrus fruits from the scale and canker infested districts in lots of from three to six are frequently found in the effects of automobile travelers. For example during the month of December, 1922, twenty-six lots of citrus fruits were found by the road inspector at Lordsburg.

Citrus Nursery Stock

The development of the Yuma mesa and the increased interest in citrus fruit production in the Salt River Valley has, as was predicted in the last report, brought on a large and authentic demand for citrus nursery stock.

The supply of citrus stock grown in Arizona has not kept pace with the demand, consequently there is at present an acute shortage of Arizona grown citrus stock. This fact was brought out at a meeting of the Commission, May 20, 1922, by Senator A. J. Eddy, of Yuma, Arizona, and M. B. Carpenter and W. J. Murphy, of Phoenix, who asked that the citrus quarantine prohibiting the importation of citrus trees be so modified as to permit the importation of trees from California under whatever restrictions the Commission might deem advisable to impose for the purpose of safeguarding the citrus industry already established in Arizona, from pest invasion.

At this meeting the entomologist stated that the method assuring the greatest degree of safety to the Arizona citrus growers would be to grow the stock in Arizona from sour orange seed and buds produced in Arizona. This procedure, however, would involve a delay of at least three years, possibly longer.

To impose such a tremendous handicap as the delay in planting involved upon the development of the Yuma project seemed exceedingly inadvisable, therefore the Commissioners were inclined to investigate the various methods of handling nursery stock that have been devised for combating insect pests attacking such stock.

Of the various methods in use the one that seemed likely to prove of greatest efficacy was fumigation in vacuum. This method of making citrus stock safe for Arizona Growers has been under investigation by the California Department of Agriculture for some time. The State Entomologist was therefore instructed to investigate the process and determine if nursery stock so treated could, in his opinion, be safely brought into the State from California and to report the results of the investigation at the next meeting of the Commission. The proposed investigation was made during the month of June, 1922.

Accordingly at the meeting held on June 30, 1922, the Entomologist reported having visited Sacramento where the experiments had been conducted. There he found trees which had been fumigated during the month of November, 1921. The trees at that date, it was stated, and scale scars on the trees substantiated this statement, were heavily infested with scale. They had made a new growth, the shoots of which were over twelve inches long in June, 1922. No evidence of scale was found upon the new shoots or leaves. Furthermore, the California authorities reported that various experts of the Department had examined the scale on the fumigated trees at various times and in no instance had they found a live specimen. The control trees (unfumigated) showed live scale in various stages of development.

At the time of the Entomologist's visit there were only a few scale on the older parts of the fumigated trees. The specimens examined were dead.

Supplementing this investigation, a telegram and letter pertaining to the efficacy of vacuum fumigation from E. R. Sasscer, entomologist of the Federal Horticultural Board, was read at the meeting. In his letter Mr. Sasscer reported the results of six experiments in which the mining scale (*Howardia biclavis*) was subjected to atmosphere fumigation using hydrocyanic acid gas. One hundred per cent kill was obtained in five of the experiments and 95 per cent kill in the remaining experiment. "It is reasonable to expect," states Mr. Sasscer, "that under vacuum conditions, we should be able to secure even better results than those just described. However, we should bear in mind that ultimate success in fumigating citrus plants infested with scale insects is dependent upon the accuracy of the man performing the work, the temperature conditions at time of fumigation, and the stage of the scale insect to be fumigated."

Briefly summing up the results of the investigation:

Vacuum fumigation with hydrocyanic acid gas under proper conditions as regards amount cyanid, exposure and temperature should be efficient against scale insects on citrus nursery stock. All the experimental evidence available substantiates this conclusion.

With the report at hand, the Commission after meeting with the Salt River Valley Citrus growers, passed a resolution authorizing the State Entomologist to permit a special importation of citrus trees into Yuma district for next season's planting, and Quarantine No. 13 was amended to that effect, stating conditions under which such nursery stock could be brought in.

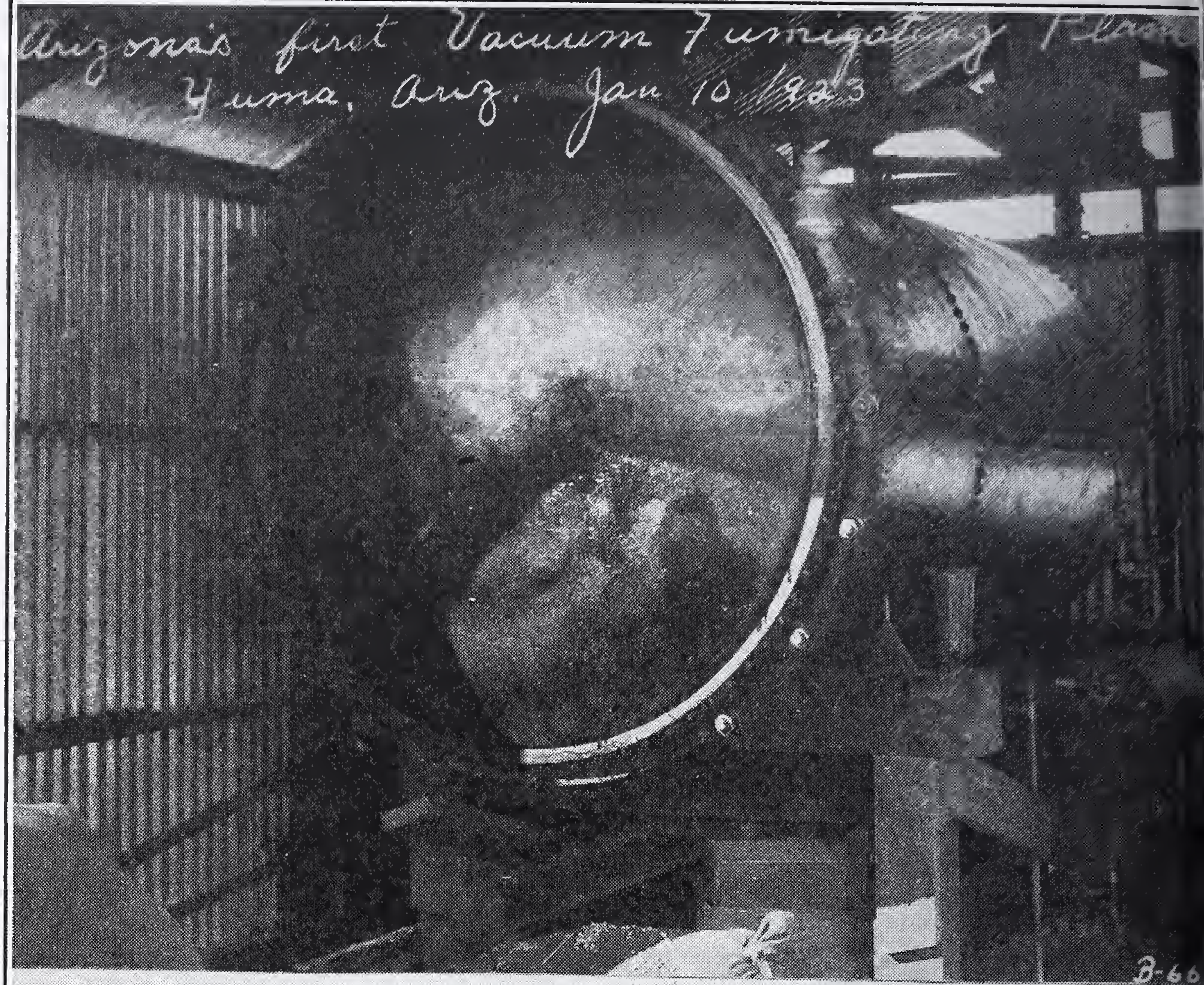
Safeguarding the Alfalfa Crop

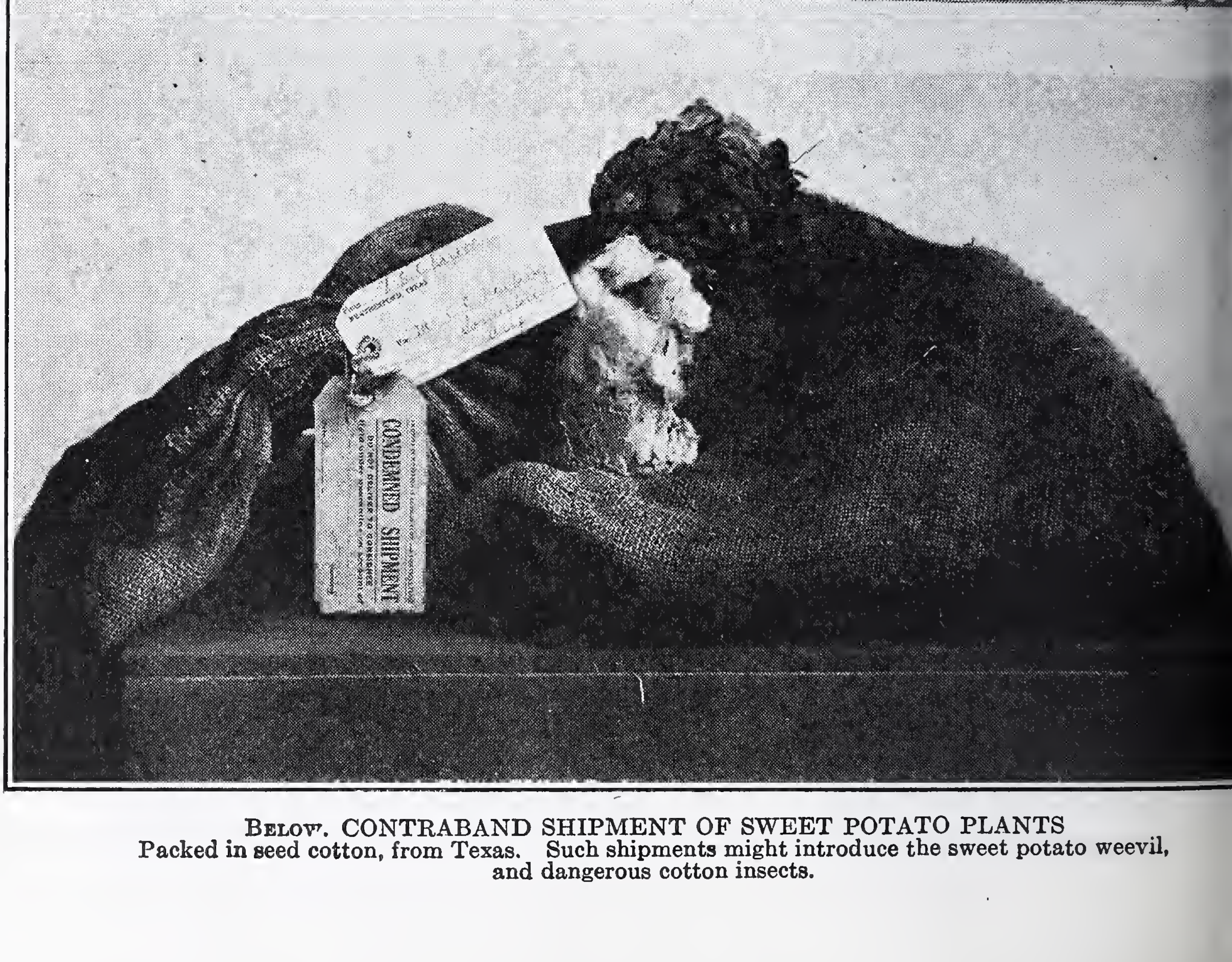
Produce dealers, millers, transportation companies and individual citizens of Arizona occasionally ask the Commission to modify the Alfalfa weevil quarantine so as to permit apples, potatoes or grain to be imported into Arizona from the alfalfa weevil infested states. In each instance these requests have been denied by the Commission because of the risk involved in introducing the alfalfa weevil.

By reason of the increased travel and immigration from the alfalfa weevil infested states, in consequence of the rapid development of Arizona's agriculture and the improvement of highways, the danger of the introduction of the alfalfa weevil is increasing each year. The need for an increased inspection force and more funds to vigorously prosecute the alfalfa weevil inspection work of the department is thus readily apparent.

Date Palm Scale Eradication

The work of exterminating the date palm scale (*Parlatoria blanchardii*), undertaken in cooperation with the Arizona Agricultural Experiment Station and the Federal Horticultural Board, has been continued. In February 1922, H. B. Skinner was placed in charge of this work and periodical systematic inspections of date palms outside of the State and Governmental





BELOW. CONTRABAND SHIPMENT OF SWEET POTATO PLANTS
Packed in seed cotton, from Texas. Such shipments might introduce the sweet potato weevil, and dangerous cotton insects.

orchards was immediately undertaken with the result that isolated infestations were found in other parts of Maricopa, Yuma and Pinal counties. These inspections are followed up by measures designed to kill the scale on the trees found infested. The work already done indicates that complete eradication of the scale can be accomplished if it is made possible to inspect the orchards as frequently as necessary. The records of the date palm inspection work follows:

Table 10

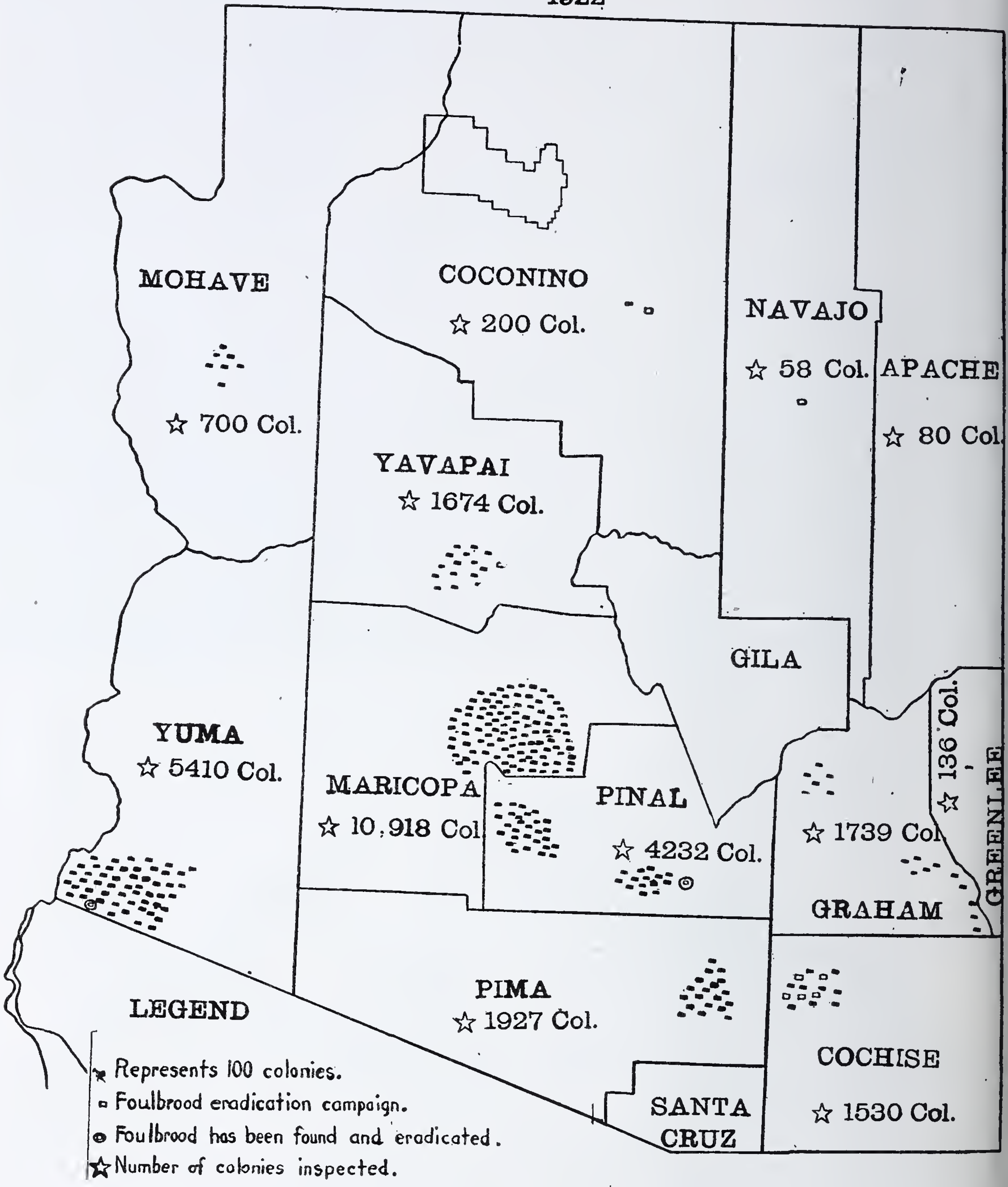
Month (1922)		University Orchard, Tempe	University Orchard, Yuma	Salt River Valley	Yuma Valley	Total
May:	No. trees inspected	718	146	613		
	No. trees infested		8			
June:	No. trees inspected	718	146	662		
	No. trees infested		9	6		
July:	No. trees inspected	718		1856		
	No. trees infested	1		3		
Aug.:	No. trees inspected	718	146	962		
	No. trees infested		11	2		
Sept.:	No. trees inspected	718		91	63	
	No. trees infested					
Oct.:	No. trees inspected	718	146	178		
	No. trees infested		19	2		
Nov.:	No. trees inspected	718	145	391	1085	
	No. trees infested		12		226	
Dec.:	No. trees inspected			3984		
	No. trees infested			1		
Total number trees inspected		5026	729	8737	1148	15,640
Total number trees infested		1	59	14	226	300

BEE DISEASE ERADICATION

Acting under the new Apiary Inspection Law which the Fifth Legislature of Arizona enacted, the department inspected colonies of bees in every county in the State excepting Gila. Foul brood was found in five counties and eradication campaigns were undertaken in each of these counties under the direct supervision of Frank E. Todd. Follow up inspection work indicates that the campaign was successful in Yuma county and that the infestation in Pinal county has also been stamped out by the heroic measures undertaken by the bee-keepers themselves prior to the

PLATE IV.

RESULTS OF APIARY INSPECTION 1922



ARIZONA COMMISSION OF AGRICULTURE AND HORTICULTURE assumption of the duties of Apiary inspector by this office. A record of the apiary inspection work of this office follows: (Also see Plate IV.) Later inspections made the total colonies inspected greater in the table than those recorded on the map.

Results of Apiary Inspection.

1921–1922

Counties	No. Apiaries Inspected	No. Apiaries Diseased	No. Colonies Inspected	No. Colonies Diseased
Apache	15	0	65	0
Cochise	73	19	3,088	150
Coconino	4	2	175	7
Graham	18	0	1,621	0
Greenlee	6	0	136	0
Maricopa	134	0	11,154	0
Mohave	15	0	757	0
Navajo	8	1	55	2
Pima	22	0	1,824	0
Pinal	57	0	4,328	0
Yavapai	35	1	1,566	6
Yuma	46	3	5,933	12
	433	26	30,702	177

General Summary.

Number of Apiaries inspected	433
Number of apiaries infected with American Foul Brood	26
Number of colonies inspected	30,702
Number of colonies infected with American Foul Brood	177
Number of colonies destroyed, American Foul Brood	177
Number of colonies infected with Sacbrood	55

POTATO AND DECIDUOUS FRUIT PEST CONTROL

The control work as in previous years was under the direct supervision of Dr. Bartlett, Field Entomologist, in cooperation with the County Agricultural agents of Yavapai, Coconino, Navajo and Apache counties.

UNCLASSIFIED MISCELLANEOUS WORK

The unclassified work of the department comprises the collection, identification, tabulation, preservation and mounting of insects already working on Arizona crops, and of specimens showing the effect of plant diseases now found within the State as well as specimens of diseased plants and destructive insects found upon imported shipments; investigation of troubles reported by growers; rearing and studying the habits of pests in the field with a view to devising means for their control; talks on pest control and allied subjects at the request of various Agricultural organizations; preparation of articles on pest prevention and control for newspapers and agricultural papers; fair exhibits, and the like. This work requires the services of one man during the entire year and other members of the staff for a part of the time.

Fair Exhibits

The department's exhibit at the State Fair, October 30th-November 4th, 1922 was due to the private collection of Perry A. Glick, the most attractive and most popular exhibit upon the grounds. See Frontispiece.

This year by means of a little judicious publicity we were able to enlist the assistance of many bee-keepers outside of Maricopa County in making the Apiary exhibit a creditable and faithful representation of the honey bee industry of the State. An illustration of this exhibit appears on page 51.

Co-operation

The work of the department has been materially aided as in past years by the identification of a number of species of insects through the courtesy of Dr. L. O. Howard, Chief of the Bureau of Entomology, United States Department of Agriculture, and his associates.

The active support and cooperation of the Federal Horticultural Board in the road inspection work, date palm scale eradication work and the wild cotton boll weevil problem has already been mentioned. This service was greatly appreciated by the Commission.

Each year the Western Plant Quarantine Board, an organization of the quarantine officials of the western states, British Columbia, Hawaii and Lower California in Mexico, is advancing toward its avowed purpose of "securing a greater mutual understanding, closer cooperation and uniformity of action for the efficient protection of our plant industries against plant diseases and insect pests."

APIARY EXHIBIT
Arizona State Fair, Phoenix

LIST OF CURRENT QUARANTINES AND OTHER RESTRICTIVE ORDERS

The numbers assigned to these quarantines indicate merely the chronological order of issuance of the quarantines in one numerical series. The quarantine numbers missing in this list represent quarantines which have either been superseded or revoked. The record includes quarantines and restrictive orders up to December 31st, 1922.

Arizona Quarantines

ALFALFA HAY. Quarantine No. 1. Prohibits the importation of nursery stock, hay, straw, grain, alfalfa seed, vegetables and fruit from Utah, Idaho and Wyoming; the counties of Delta, Gunnison and Montrose, Colorado; the counties of Baker and Malheur, Oregon; the counties of White Pine, Washoe, Douglas, Lyon, Ormsby, Pershing and Story, Nevada, on account of the alfalfa weevil (*Hypera postica*). Regulates the importations of household goods, live stock and effects of automobile travelers from the infested districts.

MEXICAN ORANGES. Quarantine No. 3. Prohibits the importation of oranges, grapefruit, mangoes, peaches, guavas, plums, Arches sapotes from Mexico. Prohibits persons in Arizona from having such fruit from Mexico in their possession on account of the Mexican Orange Maggott (*Anastrepha ludens*).

GRAPE VINES. Quarantine No. 4. Prohibits the importation of grape vines from California north of the north line of San Luis Obispo, Kern and San Bernardino counties, on account of the grape phylloxera and grape mealy bug (*Phylloxera vastatrix*) and (*Pseudococcus maritimus*). Regulates the importation of grape cuttings from that region.

OLIVE. Quarantine No. 12. Regulates the introduction of olive stock on account of certain injurious insects.

CITRUS. Quarantine No. 13. Prohibits the importation of citrus fruit, citrus nursery stock and seeds from southern states on account of citrus canker, scale insects, white fly, etc. Regulates the importation of citrus fruit, citrus stock, and seed from California on account of scale insects, red spider and mealy bug. Prohibits the introduction of Privits, Rubber Plants and Cape Jessamine from southern states and Yuba, Sacramento and Sutter counties, California, on account of citrus white flies.

SWEET POTATOES. Quarantine No. 14. Prohibits the importation of sweet potatoes and sweet potato slips from Texas, Louisiana, Florida, Mississippi, Georgia and Alabama, on account of sweet potato weevil (*Cylas formicarius*).

COTTON SEED. Quarantine No. 15. Prohibits the importation of cottonseed, seed cotton, and its products from any state, territory and foreign country, with the exception of California, on account of cotton boll weevil (*Anthonomus grandis*) and pink bollworm (*Pectinophora gossypiella*). Regulates the importation of cottonseed and lint from California.

PEACH NURSERY STOCK. Quarantine No. 16. Prohibits the importation of peach nursery stock, cuttings, scions, buds and pits of peaches, apricots and nectarines from Arkansas, Connecticut, Delaware, Florida, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Mississippi, Nevada, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, Tennessee, Virginia, West Virginia, Province of Ontario, Canada, on account of peach yellows and peach rosette.

DATE PALMS. Quarantine No. 17. Regulates the importation into the State of Arizona and the movement within the State of date palms and date palm offshoots on account of Parlatoria scale (*Parlatoria blanchardii*).

SUGAR CANE. Quarantine No. 18. Regulates the entry of sugar cane on account of certain injurious insects and fungous diseases.

STRAWBERRY PLANTS. Quarantine No. 19. Regulates the entry of strawberry plants from California, Oregon and Washington, on account of the strawberry root weevils (*Brachyrhinus rugifrons, O. ovatus, O. sulcatus.*)

Federal Quarantines

The office assists the Federal Horticultural Board in the enforcement of its quarantines. Those quarantines of particular importance to Arizona, are: Five leaf pines, currants and gooseberries. Quarantine No. 26, as amended. Prohibits the importation of currants, gooseberries and five leafed pines from any state east of and including the states of Arkansas, Iowa, Louisiana, Minnesota and Missouri; and from Washington west of the Cascade Mountain Range, on account of the white pine blister rust.

EUROPEAN CORN BORER. Quarantine No. 43, amended: Regulates the movement interstate to any point outside the quarantine areas of corn, broom corn, vegetables and cut flowers on account of the European corn borer (*Pyrausta nubialis*).

GYPSY MOTH AND BROWN-TAIL MOTH. Quarantine No. 45, as amended. Regulates the movement interstate to any point outside the quarantined area of plants and products listed therein.

JAPANESE BEETLE. Quarantine No. 48, as amended. Regulates the movement interstate to any point outside the quarantined areas of farm products, nursery stock and soil, on account of Japanese beetle (*Popillia japonica*).

SATIN MOTH. Quarantine No. 53. Prohibits the movement interstate of all varieties of poplar and willow from infested areas in New Hampshire and Massachusetts.

Other Restrictive Orders

COTTONSEED. Prohibits the intercounty movement of cottonseed and seed cotton within Arizona except by permit of State Entomologist.

BEES AND BEE SUPPLIES. Regulates the movement of bees, bee queens, used bee supplies and hives within Arizona and from other states.

AGRICULTURAL SEEDS. Agricultural seeds shall be labelled in conformity with the uniform Seed Law of Arizona.

CROWN GALL. Regulation 3. Specifies the percentages of fruit trees affected by crown gall allowable in a shipment.

WHITE FLY. Regulation 4. Specifies defoliation of nursery stock on account of citrus white flies.

PART III.

INSECTS INJURIOUS TO ARIZONA CROPS DURING 1922*

Compiled by PERRY A. GLICK

Deciduous Fruits and Vines

The Peach Twig Borer (*Anarsia lineatella*), was found to be attacking apricots in the Salt River Valley from the latter part of May until July. This is the first record in Arizona of the peach twig borer on apricots. On peaches it has been more or less abundant each year. This year it was more injurious than any other year since 1917. Possibly the damage to apricots was about 25 per cent. Utilis Russell reported that four groves near Mesa were visited and borers were found in three of them. They also were found in one grove in Scottsdale. The borers generally enter the stem end of the fruit and feed downward toward the pit, causing the fruit to rot. One produce dealer had to discontinue shipping to any long distance on account of the rot, which followed.

The Flatheaded Apple Tree Borer (*Chrysobothris femorata*), is reported by J. H. O'Dell on peaches, apricots and plums, in Phoenix and vicinity during July. One grove showed that about 75 per cent of the young plum trees were killed. One nursery was badly infested. This beetle has been more or less destructive to fruit trees in the Salt River Valley for a number of years. In 1915 it was unusually destructive to peaches and plum trees.

The Codling Moth (*Carpocapsa pomonella*). Wide spread infestation is found throughout Arizona, although a few restricted districts are reported to have no Codling moth. Dr. Oscar C. Bartlett reports orchards near Show Low, Navajo county, free from infestation. The upper part of Oak Creek, Yavapai county, contains no infestation, although in the lower part, this orchard pest is present. Considerable damage has been done to orchards around Fair Oaks, Yavapai county. W. E. McBride reports Codling moths to be present on apples and pears in Graham county, with a 10 per cent loss. There the infestation was lighter owing to no fruit being raised last year (1921), on account of frost. Where spraying was used systematically the Codling moth has been under control and infestation as low as one per cent has been reached, but if an orchard is neglected little results may be expected.

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*Based on the records and observations of the staff of the State Entomologist Office and crop pest inspectors.

The June Bug (*Cotinus mutabilis*), has been reported quite abundant from various parts of the State. It frequently attacks plums and early peaches, and in several instances has been recorded on Thompson seedless grapes during the summer.

San Jose Scale (*Aspidiotus perniciosus*). In the Salt River Valley this scale is found in a number of orchards. One pear orchard contains an abundance of scale, both on leaves, twigs and fruit, causing the fruit to be deformed and stunted. Dr. Bartlett reports that in the Gila Valley, Graham county, the scale is on practically all deciduous fruits. In Walnut Creek, near Kirkland, Yavapai county, a bad infestation is present on apples, pears, peaches and plums. In previous years this scale has been reported from the Yuma Valley in orchards.

The Grape Leaf Hopper (*Erythroneura comes*) was reported on grapes at Tucson by C. B. Brown during the summer. However, this insect is common throughout the State where grapes are grown and is considerably injurious. In a few vineyards in the Salt River Valley the majority of the leaves were affected. The small hopper punctures the leaves and the region of the puncture soon dries. When punctures become numerous, the leaves turn yellow, dry up and fall to the ground. Some vineyards were almost defoliated in the Casa Grande and Yuma Valleys. Both nymphs and adults feed upon the leaves. They may be at first overlooked, but if the leaves are disturbed in walking through a vineyard, the hoppers will be seen flying from leaf to leaf. All leaves and trash should be cleaned up and burned in a vineyard during the fall and winter, or plowed under. As the hoppers remain over winter as adults, grass in fence rows and adjoining meadows should be burned over. Spraying or dusting vines with nicotine preparations is recommended.

The Salt Marsh Caterpillar (*Estigmene acraea*), has been found injuring grapes in several localities in the State. In October in one small vineyard near Phoenix, these caterpillars had almost defoliated the vines. However, since the maximum abundance of these caterpillars come late in the season after the grapes have matured, the injury and damage to the vines is not great.

The Grape Leaf Skeletonizer (*Harrisina brilliana*). Specimens showing damage of this insect were brought into the office during August by several growers in the Salt River Valley, although no appreciable damage was reported.

Grasshoppers (*Melanoplus differentialis* and *M. femur-rubrum*). A small outbreak of grasshoppers was reported on grape cuttings and young vines in the Queen Creek district, in the early part of May. Noticeable damage was done. A single application of the standard poison bran mash controlled the grasshoppers satisfactorily.

Citrus and Subtropical Fruits

The Citrus Thrip (*Scirtothrips citri*) has for many years been the worst insect pest of the oranges in Arizona. The extent of damage varies from year to year, some years being greater. Geo. H. Libby of the Arizona Citrus Co., states that damage done to navel oranges by the thrips has been much less than in 1921. Groves that were heavily infested the previous year were almost entirely clean this year. Where alfalfa was present in the groves the injury to the oranges by the thrips was lessened or the damage negligible. In clean cultivated groves the damage was much greater. It follows that the thrips prefer the alfalfa as food rather than the citrus. Several groves in the Salt River Valley showed a decided betterment by almost a 50 per cent increase of fancy fruit over the previous year of from 80 to 95 per cent choice fruit, due to rigid spraying operations. About 100 acres of citrus was sprayed for thrips this year, a 50 per cent decrease over the previous year. Where spraying was done reports show a decided increase of good fruit.

Cicada (*Cicada cinctifera*). Some noticeable injury by cicadas was found in the citrus groves throughout the Salt River Valley. On practicaly every tree examined a few twigs were found with the characteristic egg punctures. Many of the smaller twigs died. Growers report that the cicada was more abundant this year than in previous years, and the results of their numerous punctures substantiate these statements.

The Soft Brown Scale (*Coccus hesperidum*), is reported as occurring in a few places on citrus trees. Frank Todd, found this scale at Yuma, on a limb of a citrus tree. A thorough investigation was made on other trees for infestation but no scale was present. The soft brown scale occurs in the Salt River Valley on oleanders. It has also been found on one or two orange trees in the Salt River Valley but is not an important citrus pest in Arizona.

The Cottony Cushion Scale (*Icerya purchasi*). This former dangerous pest of the citrus industry of California, is occasionally found in Arizona. It has been found in Tucson attacking Spanish Broom. This year H. B. Skinner reported a severe attack of this scale on an orange tree, a lemon and tangerine, growing in his yard at Tempe. Realizing the necessity of combating this pest, shipments of the ladybird beetle (*Rodolia cardinalis*), were obtained through the courtesy of the California Department of Agriculture. These insects were released about July 25, 1922 and in a short time no specimens of cottony cushion scale could be found, nor have repeated inspections revealed any specimens of the scale. Apparently a complete control was obtained by means of this natural enemy of the scale.

The Pomegranate Bug (*Leptoglossus phyllopus*), also known as the leaf-footed bug, has been noticed the past season to be doing some damage to pomegranates in the Salt River Valley. This large bug is both destructive to the fruit in the adult and nymphal stages, thrusting its long slender and pointed probosis through the skin of the fruit sucking the juices. The wound dries and cracks open, permitting an entrance to not only these bugs but other insects and fungus diseases. Possibly 50 per cent loss was caused by the bugs on all pomegranates noticed.

The Parlatoria Scale (*Parlatoria blanchardii*), is reported for the first time in Arizona on Palms of *Phoenix canariensis*. H. B. Skinner, Date Palm Inspector of Arizona, first found the scale on *P. canariensis* near Phoenix, on July 3, 1922. The tree was badly infested, the lower leaves absolutely killed and the upper leaves being almost white with the scale. About 50 per cent of the scales were parasitized. This tree was pruned and torched. A. J. Shamblin, of Indio, California, found a second tree infested near Phoenix, but with a much lighter infestation. The only previous record of this scale on palms of *P. canariensis* is recorded from California. On date palms (*P. dactylifera*), the scale has been injurious at Tempe, Phoenix and Yuma. The infestation amounts to three per cent. The scale at Tempe has been reduced almost to extermination from July 29, 1922 to December 31, 1922, as no Parlatoria could be found. Lady-bird beetles (*Axion plagiatum*) were found in great numbers attacking scales on both species of palms at Yuma. By pruning and torching it has been definitely proven that Parlatoria scale can be controlled.

The Marlatt Scale (*Phoenicococcus marlattii*). The oldest living imported date palm trees which are in Arizona at the present time were imported and planted in Phoenix in 1889. The Marlatt scale was introduced into the State at that time and has been here since. There has been no great material damage done to the trees, altho on a few trees infestation is heavy, and no doubt hindered the growth and development of the fruit to some extent. No successful means of eradication has been devised for Marlatt scale. However, a few attempts at spraying have been made and in one instance, at Yuma, the scale has been reduced to a minimum by spraying with cresole. The scale is found on all imported trees in the state. On the other hand very few seedling trees are infested and only where they are in proximity of imported trees.

Field and Forage Crops

A Sugar Cane Borer (*Chilo loftini*),* was reported by N. N. Dysart, near Marinette in November, occurring in some volunteer sugar cane in his fields. He states that a year or so ago he raised cane in these fields, and some of it has volunteered each year since then. The insect injury was more abundant earlier in the season. Pupae were brought into the office and were sent to Washington for determination.

The Corn Stalk-borer (*Diatraea lineolata*), is reported by C. B. Brown as occurring all over Pima county on corn. The infestation is average in comparison to previous years, the damage amounting to about five per cent. This species is similar to the large corn stalk-borer (*D. zeacolella*), and the same control measures may be used for the Arizona corn stalk-borer. After the corn has been gathered, the old corn-stalks should be burned to destroy the overwintering borers. Rotation of crops is advisable.

The Corn Ear Worm (*Chloridea obsoleta*), was prevalent in the corn districts of the State as usual. Most of the corn was injured to some extent and in a few localities the damage was considerable.

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*Dtd. by Dr. Harrison G. Dyar and Mr. Heinrich, Bureau of Entomology.

The Corn Flea Beetle (*Chaetocnema ectypa*), was found occurring on early corn in the Salt River Valley during March. Sufficient injury was done to the corn to cause owner to report infestation and to use control methods. W. E. McBride also reports the corn crop damaged to the extent of 10 per cent, in Graham county during July and August. McBride adds that "when the rains begin to come it seems to have a tendency to drive this pest away." In former years it appeared in unusual abundance in some localities in the Salt River Valley, and also in the Yuma Valley. Bordeaux mixture or arsenate of lead applied to the young plants is advised to control these little beetles.

Grasshoppers (*Melanoplus differentialis* and *M. femur-rubrum*). These grasshoppers are among the commoner species of the State. Extensive damage is usually done to field crops, such as corn, sorghum and alfalfa. C. B. Brown reports that at Greaterville the grasshoppers were 100 per cent more numerous than in the previous year, causing from 10 to 25 per cent damage to corn and sorghum. Poison bran mash may be successfully used to control these pests.

Cutworms (various spps.), have for many years been injurious to field crops in Arizona. Dr. Bartlett reports that in Coconino County, the cutworms did considerable damage to corn. Other than this record, very little injury is known to have been done by these insects to field crops the past year.

Aphis (*Aphis* sp.). This insect has been somewhat abundant in various localities in the state. W. E. McBride reports these insects as destroying about half of the wheat and barley at Pima, Graham county. The aphis feeds on the late grain, affecting the early grain but very little. McBride adds that the grain planted in February was damaged to a very great extent. About 10 per cent of the aphis were destroyed by lady-bird beetles and a small parasite, the latter depositing its eggs within the aphis. The insects were most abundant during March, according to McBride. In general throughout the State the infestation this year was about the same as during the previous years.

The Alfalfa Caterpillar (*Eurymus eurytheme*), is one of the most destructive insect pests of alfalfa in Arizona. Every year the injury to alfalfa has been widespread. The yellow butterfly is distributed throughout the State and wherever alfalfa is grown more or less damage results. If caterpillars threaten the crop the alfalfa should be cut and in this way starve the caterpillars. A report of the investigations and methods of control of this insect has been made by V. L. Wildermuth.*

Bean Thrips (*Heliothrips fasciatus*), is reported by J. H. O'Dell as doing injury to cow peas in the Salt River Valley. He reports that the leaves after being attacked by these insects turn white. No great damage can be considered since the cow peas are used mostly as a cover crop in citrus groves and fields.

The Clover Seed Chalcis (*Brucophagus funebris*), is reported as having done serious injury to alfalfa seed in Yuma. Altho there was no serious damage reported in the Salt River Valley, the pest is common here and does more or less damage each year. This minute wasp has in former years been reported as being very destructive to alfalfa seed in the State, and its damage is a serious handicap to alfalfa seed production.

The Three-cornered Alfalfa Hopper (*Stictocephala festina*). This membracid or hopper has always done more or less injury to alfalfa in the State. The insects suck the juice from the stems of the alfalfa and the characteristic feeding scars, appearing as rings or girdles, are left with a gall formation. The plant usually wilts or dies soon after. The injury to alfalfa this year is about the same as in previous years. V. L. Wildermuth† of the U. S. Entomological Laboratory, Tempe, Arizona, has done considerable investigation on this pest and reports that various types of hopperdozers may be used successfully in controlling them.

Darkling Beetle (*Discodemus reticulatus(?)*)‡. This beetle was reported by Chas. G. Melvin as doing injury to guayule (rubber) plants at Continental, during September. The beetles were eating the bark of the plants and is the first report in Arizona of this species feeding upon cultivated plants. Heretofore, the insect has been found along the roadside on highways passing through the desert regions, feeding upon native plants, especially pigweed (*Chenopodium*). Careful inspection by Roy W. Nixon failed to show definitely any serious injury caused by the beetles.

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*See U.S. Dept. of Agri. Bul. 124.

†Journal Agricultural Research, Vo. III, No. 43, p. 61, 1915.

‡Dtd. by Doctor Schwarz, U.S. Bureau of Entomology.

Vegetables and Truck Crops

The Tomato Beetle (*Ulus crassus*) was found to injure young tomato plants in the Salt River Valley in March. They attacked the young plants just at the soil line and in many cases just below the soil line, feeding upon the stems and girdling them. After the plants fall, the beetles collect in the shade and feed upon the fallen plants. Control: The use of poisoned bait as distributed for cutworms, substituting bran middlings or "shorts" for the bran is advised.

The Tomato-stalk Beetle (*Trichobaris mucorea*) was reported by H. B. Skinner as attacking young tomato plants in gardens at Tempe. They not only girdled the plant but gouged out more or less deep furrows, extending from the soil one half inch or so up the stem of the plant. They were found abundantly by Skinner on April 3, 1922, and dozens of the beetles feeding upon each plant in the gardens. Twelve days later all beetles had disappeared. About five per cent of the plants were killed. This species is a well known tobacco pest and is a near relative to the potato stalk weevil (*T. trinotata*), yet its habits are considerably different and requires another method of procedure in its control. The beetle does not burrough into the stalk but remains outside to feed. Dr. F. H. Chittenden* suggests that in the case of tobacco plants they should be dipped in a solution of Arsenate of Lead, prepared at the rate of 1 pound of poison to 100 gallons of water. It would be preferable to Paris Green. After a week or ten days, according to the growth of the plants, a second spraying with Arsenate of Lead should be made. The method of treating tobacco plants for this weevil will undoubtedly apply to tomato plants.

The Grain Bug (*Chlorochroa sayi*), was reported by D. W. Rogers from St. Johns, causing notable injury to beans, being very abundant from August to the last of September. "They flew in great swarms like bees from corn fields to grain fields." Many gardeners claimed that the great loss of their bean crop was due to this bug, but investigations by D. C. George revealed the plants to be greatly affected with the Bacterial Blight of beans. George believes that this bug may have played an important role in the dissemination of the blight. The bugs were also abundant on Russian Thistle and migrated to the beans. A similar damage by the bug was also found in Navajo County.

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*See U.S. Dept. of Agriculture Bulletin No. 38.

The Bean Ladybird Beetle (*Epilachna varivestris*). This is the well known Mexican Bean Beetle which is so destructive and so widespread throughout the southwest. The damage varies locally, for in some districts of the State, it may reach as high as complete destruction of beans, while in other localities the damage may be much less or negligible. W. E. McBride reports that this ladybird beetle was common in Graham County, causing about 5 per cent loss to beans. He found great numbers in December under old rotten logs and rubbish along ditches. Spraying with arsenate of lead is advisable.

The Corn Ear Worm (*Chloridea obsoleta*), was found to be doing some injury to beans in Graham County, during April and May.

The Cabbage Butterfly (*Pontia rapae*), has already been of great importance in this State, causing annually a serious loss to the cabbage. A great amount of cabbage is grown in Skull Valley, near Prescott, and here injury is greatest. The damage varies considerably, as in some fields, there may be a complete loss, while in others as low as 10 per cent may be caused. Where control measures are persistently used the loss was greatly reduced or negligible. In the Salt River Valley the injury to cabbage by this insect is appreciable. Using an arsenical in soapy water is advisable. Place 4 pounds of laundry soap in several gallons of water, then stir in one and one-half pounds of powdered arsenate of lead. For one gallon use one-half ounce of powdered arsenate of lead, and one inch cube of soap.

The Cabbage Looper (*Autographa brassicae*) is so closely correlated with the presence and damage of the cabbage butterfly that the two may be regarded alike. The extent of damage is practically the same, as they occur in similar abundance. In Arizona they were found abundant according to Dr. Bartlett wherever the cabbage butterfly occurred. Control measures are the same for both species.

The Harlequin Cabbage Bug (*Murgantia histrionia*), was reported by Dr. Bartlett as doing some damage to cabbage in Skull Valley. However it came too late there to cause extensive loss. This bug sometimes known as the "Calico Bug" was first reported in Arizona in 1913 from McNeal. Since then they have been found to occur on wild weeds in the Verde Valley, the weeds growing next to the river. The bugs have been found attacking cabbage in the Gila Valley, but not in the past year. This pest should be well watched and occurrences of its injury should be reported immediately as it is capable of doing great injury to cabbage.

The Colorado Potato Beetle (*Leptinotarsa decemlineata*), has been very destructive to potatoes this year. Dr. Bartlett reported that at Red Lake, near Williams, Coconino County, several fields of potatoes were completely destroyed. At Garland Prairie the infestation was very bad in some fields, a 100 per cent damage resulted. Some injury was reported from Prescott. Where control work was started good results were obtained. The following control method may be used successfully as is advised by the U. S. Bureau of Entomology: "Use arsenate of lead in proportion of two pounds of powdered form (or 4 pounds of paste) to 50 gallons of water. Mix first with small quantity of water and then stir thoroughly into the full amount. Apply with good pump throwing a fine mist. Cover the foliage completely. Begin spraying when the beetles first appear. Spray for the slugs when the eggs are hatching and repeat as often as necessary."

The Potato Blister Beetle (*Epicauta pardalis*), was reported by C. B. Brown as doing damage to potatoes at Continental. Plants were partially defoliated. At Greaterville, in many gardens potato plants were entirely defoliated, causing a complete loss. Arsenate of lead spray was used, killing 80 per cent of the beetles.

Aphis (*Aphis gossypii*), has been recorded as doing damage to potato vines, in the Salt River Valley in May. However, their natural enemies control them, and lessened their further spread and injury.

Aphis brassicae is also commonly found on cabbage throughout the State and causes appreciable damage.

Cutworms (various spps.) were reported on melons near Phoenix. One field was entirely devastated by these worms and replanting was necessary. Poison bran mash was used and the second crop was saved. They were also bad on potatoes in the north, especially to the young plants. In Coconino County Dr. Bartlett reports that nearly 200 acres of potatoes were badly damaged, a part of which were killed. Also 20 acres of beans were destroyed. This is the heaviest infestation of cutworms on any crop this year, in the State.

The Western 12-Spotted Cucumber Beetle (*Diabrotica soror*), has not been so important this year. However, in a number of cases melons and cucumbers were slightly damaged. Frank Todd reported that at Yuma, the injury caused by this beetle to melons was of considerable importance, and control measures were necessary to apply in order to save the crop. Control: Dust with mixture of calcium arsenate powder 1 lb., land plaster 20 lbs., when plants appear above ground and later as needed.

Melon Aphis (*Aphis gossypii*), always plays an important part in the growing melons in the State. They were reported by Haywood Short from Parker, Yuma County, on melons. The earlier crops, however, escaped injury. Dr. Bartlett reported slight damage in Coconino County. In the Salt River Valley one early crop was so badly injured that replanting was necessary. It is difficult to raise a late crop due to the aphis. The lack of injury in the Salt River Valley this year in comparison with last year was quite noticeable and commented upon by many growers. Earlier in the season the aphis was very abundant. However, the conditions favorable to the development of the natural enemies arose causing a rapid decrease in the prevalence of the insect.

Leaf Beetle (*Delcyala clavata*). This beetle was reported by J. H. O'Dell as having injured chile plants. During August of 1923 these Chrysomelid beetles were found in the Salt River Valley in various truck gardens where chile was grown. They ate large holes in the leaves and remained on the underside of the leaves during the day feeding. If plants were disturbed the beetles would quickly take flight. Their natural food plant in Arizona is the ground cherry. No larvae or eggs were found on chile plants. Control: Spraying with arsenate of lead is advisable if adults or larvae are in damageable quantities. Use 1 oz. of powdered arsenate of lead to 2 gallons of water.

Deloyala clavata. X 5.4.

The Salt Marsh Caterpillar (*Estigmene acraea*), is usually found on many kinds of vegetables. Near Phoenix during October, it was abundant on asparagus and did considerable damage, stripping most of the plants. It also was found injuring beets, lettuce and turnips.

Grasshoppers (*Melanoplus differentialis*, *M. femur-rubrum*, and *Dissosteira carolina*). These grasshoppers are among the most common of the destructive species within the State, and to them may be laid considerable injury to vegetables. Near Phoenix, as late as November 1, a lettuce grower reported that grasshoppers completely destroyed his young lettuce, although he got rid of them by the usual method of applying poisoned bran mash. In the northern part of the State, according to Dr. Bartlett, grasshoppers, particularly the dusty road and red leg grasshoppers did notable injury to grain.

The False Chinch Bug (*Nysius minutus*), has sometimes been reported on various vegetables and field crops in Arizona. It was reported as being very abundant in an uncultivated field near the Indian School, Phoenix, but no damage done, since the land was covered with weeds and waste vegetation.

Cotton

The Cotton Bollworm (*Chloridea obsoleta*). This insect has done the greatest damage to the cotton during this year. J. H. O'Dell reports that more or less damage has been found in practically every cotton field in the State. The larva occurs in the bolls, eating out the content of the boll. The damage in Arizona by the cotton bollworm is estimated to cause about one per cent loss. In some fields, however, the loss may reach five per cent. There has been no noticeable increase or decrease of infestation this year from previous years.

The Cotton Leaf Perforator (*Bucculatrix thurberiella*). The larvae of this moth has for many years been found to be doing slight damage to cotton in Arizona. It is distributed throughout the cotton growing districts of the State, but no appreciable injury has been reported for this year. In former years it has been injurious to some extent.

Salt Marsh Caterpillar (*Estigmene acraea*). Caterpillars of this moth have been found abundantly throughout the Salt River Valley. The caterpillars are polyphagous, eating a great variety of plants. However, the injury to cotton is negligible, since the maximum abundance comes so late in the season that the cotton has reached maturity. After the early frosts the Salt Marsh caterpillars migrated in great numbers from the cotton fields and attacked other plants which were not injured by the frosts. While many cotton plants were stripped of their leaves, the bolls remained uninjured.

Cotton Leaf Worm (*Alabama argillacea*). This well known pest of cotton has been reported in former years as doing some injury to cotton. J. H. O'Dell reports that some damage due to the cotton leaf worm was found in fields near Tucson the last of August. Several cotton fields in the Salt River Valley have also been slightly damaged. The progress of this moth should be watched, as it is capable of causing extensive loss to cotton.

The Arizona Cotton Stainer (*Dysdercus albidiventris*), has always played an important part among the cotton pests of the Salt River Valley. The insect is reported to have occurred in large numbers near Scottsdale and Florence, but the extent of damage in these localities is not known.

The Cotton Square Dauber (*Lygus elisus var. hesperius*), has always been present in more or less numbers in the cotton fields of the State. Reports of the cotton inspectors show that practically every field visited in the cotton districts of the State, these square daubers were present. While the damage is not great, yet some injury was noted on the newly-formed squares and bolls.

The Brown Cotton Bug (*Euschistus impictiventris*), is reported for this year to be doing damage at Yuma. This bug attacks the bolls and renders one or more of the locks worthless. In the Salt River Valley they were common but did not cause any appreciable damage.

The Green Cotton Bug (*Chlorochroa sayi*). The same records for the above description of the brown cotton bug may be used for the green cotton bug. This species has been found a very formidable cotton pest throughout the southwestern states, both to cotton and grains and is commonly known as the grain bug. Cleaning up and burning the weeds and trash in the fall and winter is advised for the reason that it will effectively reduce the numbers of overwintering forms.

The Cotton Aphis (*Aphis gossypii*), has caused considerable damage to cotton in Arizona in former years. The distribution of this pest was more restricted for 1922. In some fields it was prevalent. J. H. O'Dell reports that a field was badly infested with the aphis early in the growing season and spraying with nicotine sulphate gave very good results. As a usual rule spraying is not advisable for the reason that their natural enemies are sufficient in controlling them without the cost of artificial means.

The Differential Grasshopper (*Melanoplus differentialis*), has been found to cause damage to two or three fields, as reported by O'Dell. Plants were partially defoliated by this grasshopper, the latter having migrated from adjacent alfalfa fields that had been recently mowed. Poison bait was used and good results obtained.

The Cicada (*Cicada cinctifera*), has caused serious damage to cotton fields in former years. During July of this year it was unusually abundant. A number of reports have been received, also observations made, of the injury to cotton plants by the egg punctures of this insect weakening the fruiting branches to such an extent that they are easily broken off.

Shade Trees and Ornamentals

The Cottonwood Leaf Miner
(*Proleucoptera albella* Cham.)

During the late summer and fall of 1922 numbers of complaints were made concerning an insect which was defoliating the cottonwood trees throughout the Salt River Valley. On examining the trees, it was clearly evident that a lepidopterous larva was the insect in question. Every tree was affected more or less and some trees appeared as they normally do in the late fall. The ground was covered with partially eaten and dead leaves, and often the limbs were completely defoliated.

The larvae became very annoying to pedestrians by reason of the fact that they let themselves down from the tree by long silken threads. They would spin this silken thread until they reached some object below and frequently dropped upon people passing.

During the summer of 1921 Mr. Mote states that the larvae were very plentiful on cottonwoods. They suspended themselves in such great numbers by their silken threads that the silk became so tangled by the wind, that it appeared as masses of spider webs—the latter which are commonly seen dangling from telephone wires and fences. Moths were not reared from these larvae and it is not known whether it was the same species as on the cottonwoods of this year—but in all probability it was the same insect. As soon as moths were secured from pupae obtained from cocoons on the leaves, they were sent to and identified by Dr. Annette F. Braun, Cincinnati, Ohio, as *Proleucoptera albella* Cham.

LIFE HISTORY

The *egg* is ovate and the surface is elevated and rounded. Irregular furrows and ridges over entire surface of egg. A somewhat flared and flattened border around base of egg which helps in gluing it to surface of leaf. The egg is white in color, and translucent in places. The egg mass is arranged in parallel rows containing from nine to fifteen eggs. Length of egg, .3 mm. to .4 mm.; width .29 mm. (Plate VI, Fig. 1.)

The moths readily oviposit on the sides of glass vials in the laboratory but most of the eggs prove to be infertile. Eggs were deposited in the laboratory during the early fall, although eggs were not found on the leaves at this time.

Larva. The larva is very light lemon yellow in color with no markings. Numerous long setae are scattered over the thoracic and abdominal segments. Spiracles on prothorax barely evident and abdominal spiracles very pale in outline. Last abdominal segment with several small setae directed caudad. Head very light in color similar to body. Mandibles chitinized. Ocelli not prominent. Head with several long setae directed cephalad. Head very much flattened and directed cephalad. Clypeus and labrum dark brown. Epicranial suture very faint, scarcely evident. The entire head capsule is translucent, and the tentorium shows distinctly through the surface of vertex and front. The outline of the head is angular. Length of larva 5 mm. to 6.5 mm. Width .8 mm. to .9 mm. (Plate VI, Fig. 2.)

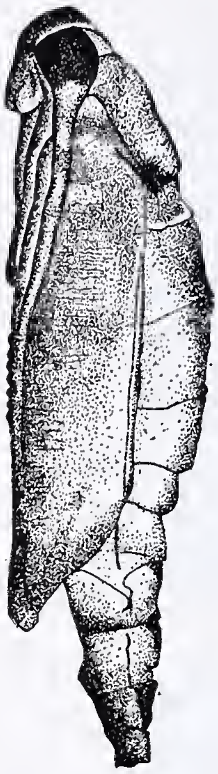
The flattened head serves perfectly for its leaf-mining characteristics. The larvae are very active and if disturbed from feeding between the leaf tissues will immediately drop from the leaf. They usually mine the entire leaf leaving only the delicate vein structure.

Pupa. (Male). The ground color of the pupa is dark brown. The ventral aspect is much darker than the dorsal surface. The eyes are very dark in color. The head slightly lighter in color than the caudal aspect. The profemur and the metatarsus are very light in color, contrasting with that of the other sclerites. The antennae curve normally and extend to the IV abdominal segment. Metatarsus extends beyond antennae to slightly past the VIII abdominal segment. The wing pads extend slightly beyond the metatarsus; they are long and curve rather abruptly to a rounded point, curving dorso-caudad.

The dorsal aspect is very light in color. There is a white line extending from the prothorax to end of mesothorax. The last three abdominal segments are very dark in color. The wing pads project mesad and do not touch the abdominal segments but the mesothoracic wing is fused at IV abdominal segment, the metathoracic wing being free and recurving dorso-caudad. Length 3.2 mm.; width .9 mm. (Plate VI, Fig. 4.)

The female pupa is much lighter in color. The dorsal aspect is very light in color and the last three abdominal segments are slightly darker.

PLATE VI.



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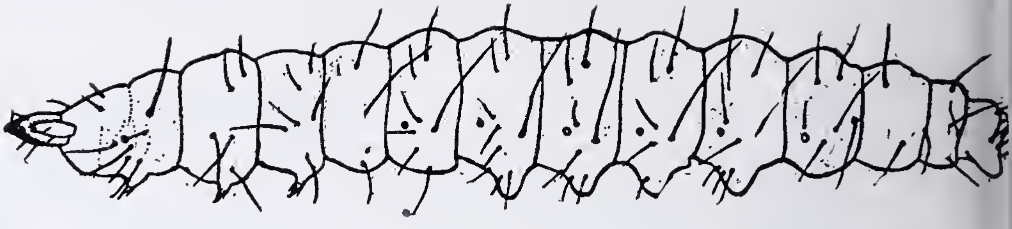

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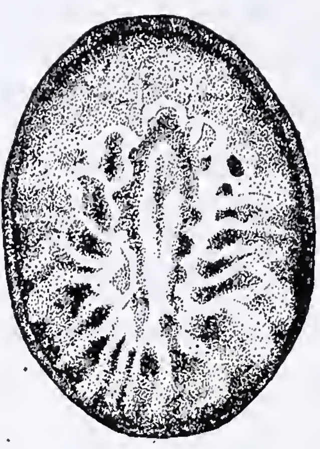

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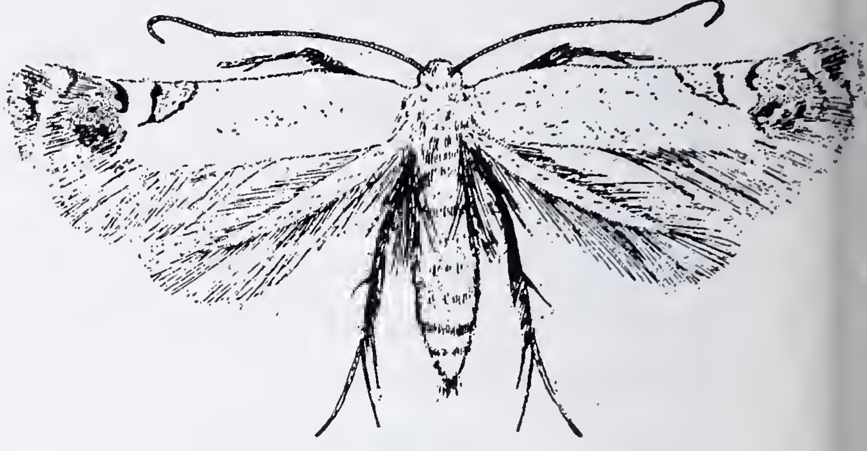

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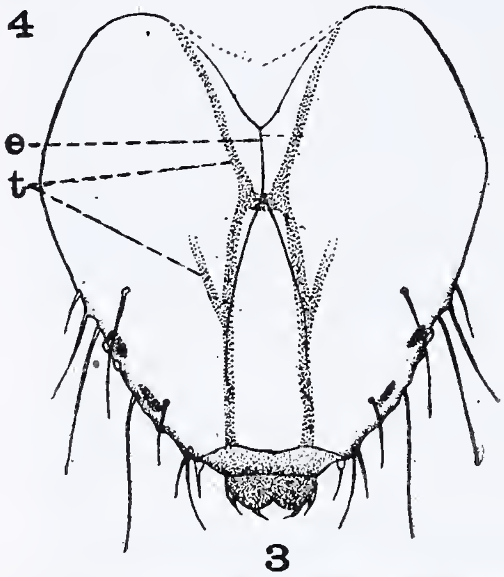

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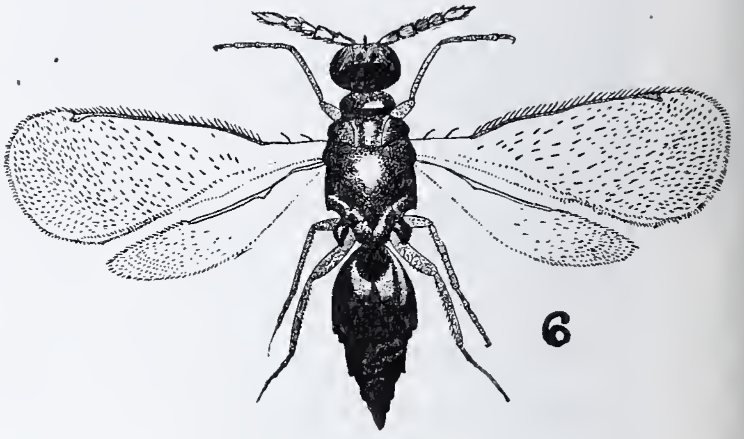

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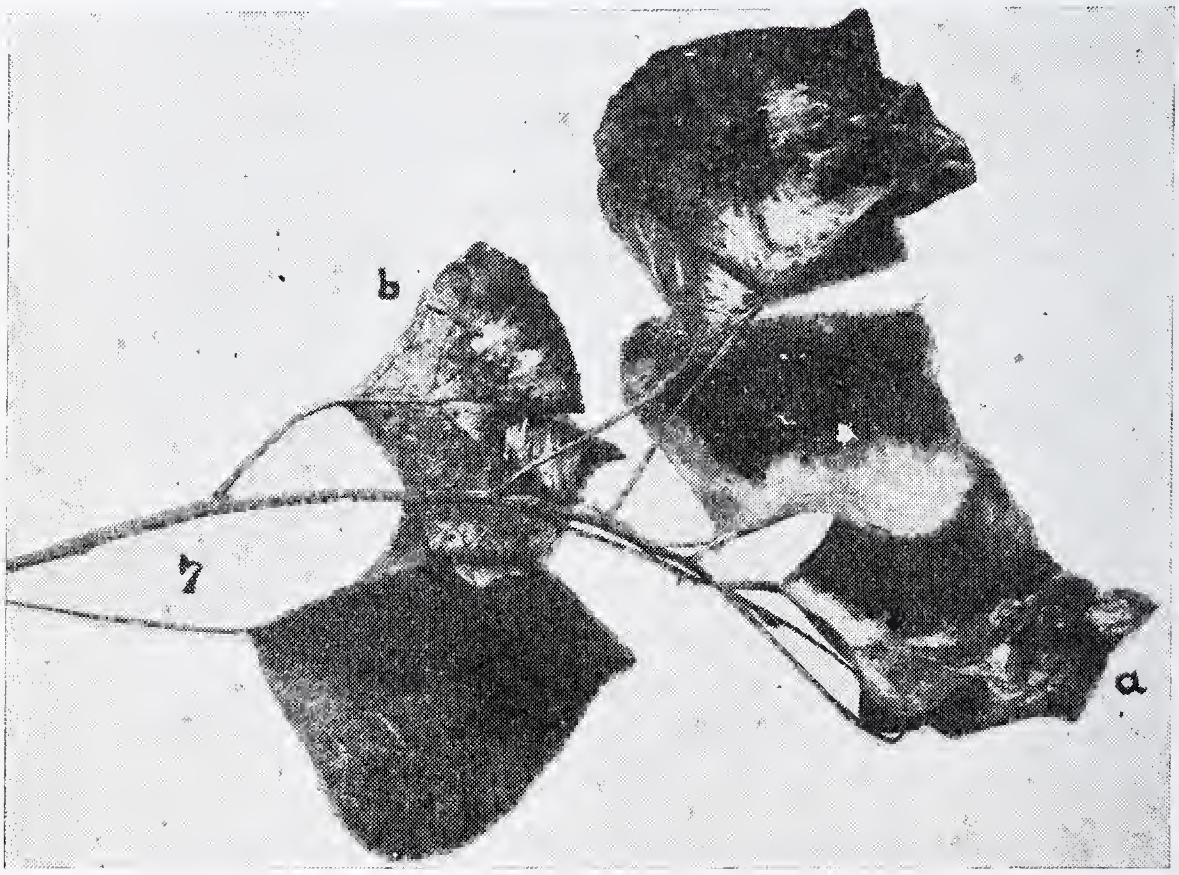

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Drawings by P. A. Glick.

EXPLANATION OF PLATE VI.

Life Stages of the Cottonwood Leaf Miner

(Proleucoptera albella Cham.)

1. Egg. X 82.5.
2. Adult larva. X 12.
3. Head capsul of adult larva: e, epicranial suture; t, tentorium.
4. Lateral aspect of pupa. X 17.67.
5. Cocoon showing Y-shaped appearance. X 7.5.
6. Parasite of pupa (*Horismenus*, n. sp.)
7. Photograph of cocoons on leaf. a, winter cocoons in terminal leaves; b, summer cocoons on leaf. Original.

The wing pads extend slightly further than do those of the male pupa. The ventral aspect is uniformly lighter in color. Length 3.1 mm.; width .9 mm.

The pupa is contained in a very light cocoon placed under a very characteristic bridge-like mass of silk. The larva bends the leaf or spins in a partly curled portion of a dried leaf and fastens the silk from one angle of the leaf to the opposite side. The end of the bridge divides giving a Y-shaped appearance to each end of the bridge. (Plate VI, Fig. 5). Under this bridge of silk is spun the cocoon. The winter cocoons may have this characteristic form, but the larvae usually fasten several terminal leaves together and spin their cocoons between them. (Plate VI, Fig. 7a). The winter is passed in the pupal stage. If the larvae drop to the ground they may crawl into the leaves on the ground, or under any waste material or trash and there spin their cocoons. If shrubbery grows beneath the branches of the cottonwood trees, the larvae may drop on the foliage and spin their cocoons.

Adult. The female moth is larger than the male. It is almost entirely white. The fore wings are fringed with long white hair-like scales. There are two spots of yellow near the terminal end of the wings bordered by black˙ These are the only markings on the wings. The hind wings are entirely white fringed with hair-like scales. The wings are long and narrow. The body is white. Length (female), 8.2 mm.; male, 6.4 mm. (Plate VI, Fig. 8.)

The moth is very small and may be easily overlooked. They emerge throughout the winter both in the laboratory and out of doors. Moths were frequently found on the ground during January, having emerged during the day, especially after a rain, as evidently the cocoons are softened, and the comparatively warm sunshine causes them to emerge. Moths are not often casually observed in the field as one might suppose from the superabundance of the larvae.

ENEMIES

Larvae on cottonwood trees bordering canals and irrigation ditches fell into the water in great numbers. Along the large canals where fish may be found, many of the larvae were eagerly snapped up by the fish. Possibly the greatest check on this insect is a small wasp (*Horismenus* n. sp.).* The wasp parasitizes the pupa and from various counts it was determined that about 60 per cent of the pupae were parasitized. Possibly the coming season this moth will be in much less numbers owing to their decrease by this parasite. (Plate VI, Fig. 6.)

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*Dtd. by A. B. Gahan, U. S. Bureau of Entomology.

Control

Owing to the lateness of the season when the larvae were at their maximum abundance, they did no great harm to the trees. The trees were about ready to shed their leaves and frost killed many of the larvae in the leaves. If the greatest abundance of the larvae came early in the summer possibly the trees would be damaged to considerable extent. Raking up the leaves and burning them or plowing them under is advisable. Inasmuch as the parasites would likewise be killed by burning the leaves this method may not prove to be the most desirable. Further investigation is necessary in order to determine the date when the parasites are on wing at their maximum abundance before specific burning dates could be recommended.

The Goldsmith Beetle (*Cotalpa lanigera*), is one of the most common of Arizona beetles and is found attacking cottonwood trees throughout the State. C. B. Brown reported that at Tucson the trees were completely defoliated. They were also very common this year in and around Phoenix. These trees were most heavily attacked near the edges of the desert. The maximum abundance of the beetles occurred in the spring from the last of April to the first of July. Cottonwoods are not killed but the appearance of the trees is far from desirable.

The Flat Headed Apple Tree Borer (*Chrysobothris femorata*), was found in roses at Phoenix. Some damage was done, the borers having attacked the large and older bushes. This beetle is a rather common pest of roses in the Salt River Valley. However, it usually attacks the older bushes entering through the wounds made by the pruning shears.

The Common Red Mite (*Tetranychus telarius*). Mr. Mote reported this mite to be very troublesome to the Arbor Vitae trees of Phoenix. The mites were very abundant during April. Many of the branches were completely webbed, the mites crawling around within the webs. The small leaflets were killed and the entire tree assumed a dusty brown appearance. The webs and brownish fronds were unsightly and the ornamental effect of the tree was depreciated. During the hot summer weather the mites were not so evident, altho numerous enough to lessen the green appearance of the trees. Trees or branches shaded were more abundantly infested. The Arbor Vitae trees were not permanently injured, however, for as soon as the mites began to disappear new leaflets came in, leaving the tree in an apparently good condition.

Ivy or Oleander Scale (*Aspidiotus hederae*). This scale occurs on a number of the hosts in the State. At Clifton, Greenlee County, it is reported on ornamentals. It has been found common on ivy and oleanders at Tucson.

The Soft Brown Scale (*Coccus hesperidum*), has been associated with oleanders for many years in the State. While no bushes were killed, yet the leaves may look sickly, turn brown and drop off. Often a few limbs are killed and detracts from the appearance of the bush. There is always more or less soft brown scale on nearly every oleander in the Salt River Valley. Usually parasites hold this insect in check.

The Rose Scale (*Aulacaspis rosae*), is reported doing some damage. H. B. Skinner reported the scale on rose bushes, growing in his yard. The scale had gained a firm foothold on the plants. The roses were burned. Dr. Bartlett reported that at Scottsdale, blackberries were killed by the rose scale. It has been found in the State for the past ten years doing some damage to roses and blackberries.

The Cottony Cushion Scale (*Icerya purchasi*). Very rarely reports come into the office of this scale attacking ornamentals in the State. Specimens of the cottonly cushion scale were brought into the office during September, the scale having been found on rose bushes in a yard in Phoenix.

Household

Numerous inquiries come into the office concerning insects which are common in houses of the State. A few of the commoner species are listed below with the methods of control.

The Silverfish, or Fishmoths, are little insects which are well known to housekeepers. This insect is a glistening silver gray color, wingless, and about one-half inch in length. It has two long antennae from the head and three long antennae-like appendages from the tip of the abdomen. The insects run very rapidly from their places of concealment when disturbed. Control: Use poisoned baits spread upon bits of paper or cardboard, and place in their haunts. Very thin glue 1 pt., powdered arsenate of lead or Paris Green 1 tsp. Stir thoroughly. Pyrethrum Insect Powder scattered liberally about their haunts is also recommended.

Roaches (*Periplaneta americana*). This species of roach, known also as the American roach, is possibly the best known to housekeepers in the State. They are large flat brown insects and hide during the daytime in cracks and any place of concealment in the house. Control: Use chocolate mixed with borax, equal parts. Plaster of Paris mixed with flour or with chocolate is also advised. Sodium flouride is recommended as being the best poison and repellent, used by dusting in their hiding places, such as cracks, crevasses, underneath enclosed sinks and the like. They may be controlled by fumigation or trapping.

The Carpet Beetle or "Buffalo-Moths" (*Anthrenus scrophulariae*), are often found destroying stored fabrics, rugs and carpets in houses and stores. The larvae are the most injurious. They are small, very soft-bodied, thick and hairy. They vary in color from brown to dirty yellow. The beetles are about one-eighth inch in length, oval shape and dark in color with light yellowish markings. Eggs are laid in the clothing or whatever food material the beetle finds convenient. Control: Air all clothing, carpets, and rugs, beating the two latter thoroughly. Use gasoline in cracks of floor to kill young. Fumigation with carbon bisulphide is advisable, placing materials in a trunk or tight closet, but be sure there is no flame near place of fumigation, as carbon bisulphide is highly explosive.

Clothes moths (*Lepidoptera*), are frequently found to be a pest of considerable importance to housekeepers and to dry goods and clothing establishments. These are true moths and the larvae is the destructive form, occurring in small silken cases covered with lint from chewed materials. The larva are whitish caterpillars. The moths lay their eggs on the clothing or carpets. Control: A similar method of control for carpet beetles may be used for the moths. Storing goods in rooms above 90° continually is recommended and is as effective as is cold storage.

House Ants are very annoying and during the summer cause considerable trouble to housekeepers. There are several species ranging from the small red ants to the large black desert and stinging ants. Control: The following formula* is recommended by entomologists and is very adaptable for warehouses and stores—Poisoned syrup is made using

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*Woglum and Neuls, Farmers' Bulletin 862, U. S. Dept. of Agr.

Granulated sugar	pounds	15
Water	pints	7
Tartaric acid (crystallized)	ounce	¼
Boil for 30 minutes. Allow to cool.		
Dissolve sodium arsenate (C.P.)	ounce	¾
In hot water	pint	1
Cool. Add poison solution to syrup and stir well.		
Add to the poisoned syrup:		
Honey	pounds	1½
Mix thoroughly.		

Place poisoned syrup in a suitable container. Mr. Mote suggests as an effective repellent, used to keep ants out of houses, refrigerators and cupboards comprises a narrow strip of cotton tape soaked in a saturated solution of bichloride of mercury ($HgCl_2$). The tape is then tacked around the base of the cupboard, refrigerator or around the place through which the ants are gaining entrance into the house and ants refuse to cross the tape.

Fleas are frequently reported infesting houses and domestic animals. Animals usually cause infestation in houses and on man, and thus are accidental visitants on man. Control: Eliminate breeding places. Washing, or dipping animals in a solution containing insecticide soaps, or stock-dip is advisable. Kerosene emulsion parts 1 to 15, the oil thoroughly emulsified, is recommended. Dusting animals with naphthaline powder will cause fleas to leave. In breeding places gasoline and kerosene treatment may be used effectively. Clean up all the rubbish, soaking the ground with salt water. In houses, scrub floors thoroughly and also use a vacuum cleaner where possible. Fumigation may be advisable in houses infested with fleas. If the building is fairly tight, hydrocyanic acid gas* may be used, 5 ounces cyanide per 1,000 cubic feet of space; or by burning sulphur at the rate of 4 pounds per 1,000 cubic feet of space. Where fumigation cannot be practiced, sprinkle flaked napthalene over the floor at the rate of 4 or 5 pounds to each 200 or 300 square feet, closing the doors for several hours and then sweeping the material containing the stunned fleas. Pyrethrum may be used in a similar manner.

The House Fly (*Musca domestica*), is undoubtedly the best known insect pest in houses of every locality. Fortunately, however, due to the seasonal climatic conditions such as excess temperature and lack of sufficient humidity, the number of flies are lessened. Flies are frequently very abundant during the first part of November and January in the Salt River Valley. In the spring and fall they are more abundant than in the summer. In other localities of the state the season of their maximum abundance varies. The hot, dry summers of Southern Arizona are decidedly unfavorable for the flies but during the mild winter months when the rainfall comes, the flies appear. However, they are greatly reduced in numbers in comparison to their summer appearances in other states. Control methods for flies are well known and need not be outlined.

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*The fumes of this gas are highly poisonous and extreme care should be practiced in its use.

Attention

The above records of insects injurious to crops in Arizona for 1922 is in no way complete. It is impossible to obtain records from every locality where insects may be doing damage. The field men and inspectors cannot be in every locality and thus the Staff of the State Entomologist's Office strongly urges you to send in reports of any insects which you may find injuring any vegetation. If you do not know the insect or plant, kindly mail both, when possible, and in this way the data will be made more complete. It is advisable to send insects dead, as if live material is shipped and proved to be very injurious there would be danger of scattering such insects enroute, should some be able to escape. Insects should be killed by placing specimens in a closed jar containing a few drops of chloroform, or some cyanide of potassium. A few drops of gasoline may be placed on the head of an insect, killing it without discoloring or damaging it, but never use kerosene or turpentine. Place insect between layers of cotton and pack in a small wooden or tin box, never in paste board boxes or in envelopes. If pupae, larvae or caterpillars be sent, these may be placed in a small vial or bottle containing a diluted solution of formaldehyde (formalin). The latter may be obtained from any drug store. Eggs may be sent as found without killing, in layers of cotton.

Any information concerning control measures, which you may wish to know, the office shall be pleased to help you. In this way we will be better able to cooperate with the people of the State.

PART IV.

THE SURVEY OF MYELOIS VENIPARS DYAR IN ARIZONA

By

PERRY A. GLICK

During the past year considerable attention has been centered on the investigations of an insect reported to be damaging the navel oranges throughout the orange groves of the Salt River Valley. The presence of the larvae of this insect in Washington Navel oranges was brought to the attention of the Department early in July, 1921. Complaints came into the office and inquiries were frequently made as to what could be done concerning the dropping of oranges. Brief mention of this insect was made in the last report under the title of "Proposed Work for the Fiscal Year 1921-22, and in June, 1922, a progress report of the investigation of this insect was made at the 4th Annual Convention of the Western Plant Quarantine Board.

On investigation of the groves in question, a disease known as Black Rot of Navel Oranges (*Alternaria citri*) was discovered. This disease, according to records and reports of the grove owners, has been present in the Salt River Valley for many years and associated each year with a drop of more or less abundance.

Associated with many of the fallen oranges, numbers of pinkish larvae were discovered and it was superficially concluded by F. H. Gates and many grove owners that the larvae might have definite relation to this disease, and the "drop."

As soon as moths could be obtained from larvae, they were sent to Washington for identification, and were determined by Dr. Harrison Dyar as *Myelois venipars* Dyar.

The Survey

The observations made by Gates covered a period from August to December, 1921. He found larvae in practically every grove visited. Gates concluded that the feeding habits of the larvae were such as to make it a potential pest of considerable importance.

Richard Jones continued the survey from January to the last of March, 1922. He reported finding no larvae in the fallen oranges during that time. Since no systematic records were kept during April up to May 20, nothing can be said whether or not the larvae were present during this period. From May 20, to June 1, D. C. George made frequent trips to the groves but his results were negative.

Beginning in the early part of June, J. H. O'Dell continued the survey. His investigations show that no larvae were found until July 27, at which time the larvae were found in abundance. Trips had been continually made several times per week through June and July, with the result that not a trace of *Myelois venipars* in any of its early forms were discovered. Two trap lights were in operation from May 26 to July 25, but no moths taken. Both Mote and O'Dell recorded a few cases where larva were found in navel oranges that were apparently normal, but such occurences were very rare. Eggs were found on normal navel oranges but again rarely. O'Dell concluded that the larvae is a secondary pest, attacking as a rule only such fruit as would not be saleable as first class fruit. His observations overlapped those of the writer, the latter having commenced on October 1, 1922 and continuing at the time of writing.

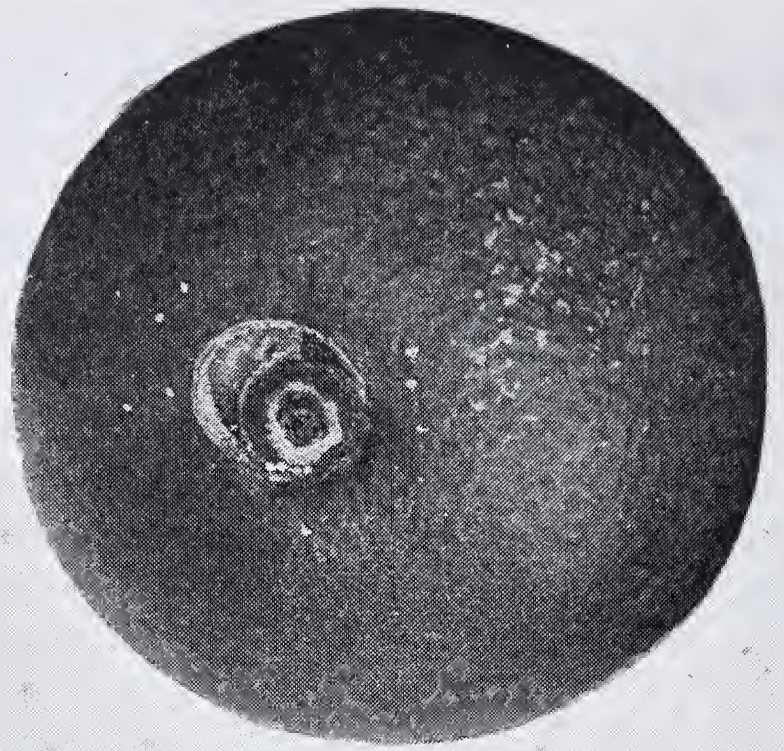
Host

Oranges are the primary food of the larvae and navels are most frequently infested. This is due to the fact that of oranges the navel orange is most frequently imperfect or defective by reason of its navel end. Sometimes the navel end does not grow perfectly and if the orange has a tendency to split, commences at the place of the imperfect navel.

Valencias do not usually split and in consequence are not often affected with the rot. These oranges are smooth at the blossom end and thus gives a minimum surface for the rot to enter. In a few groves only, was the rot found to affect the Valencias and Mediterranean Sweets. Many of the oranges in these groves were split thus affording an entrance for larvae and rot.

Sour oranges are not affected, although Utilis Russell discovered one sour orange containing a full grown larva. The orange was partially decayed by parasitic fungi.

One lemon was found by Russell containing a larva. The



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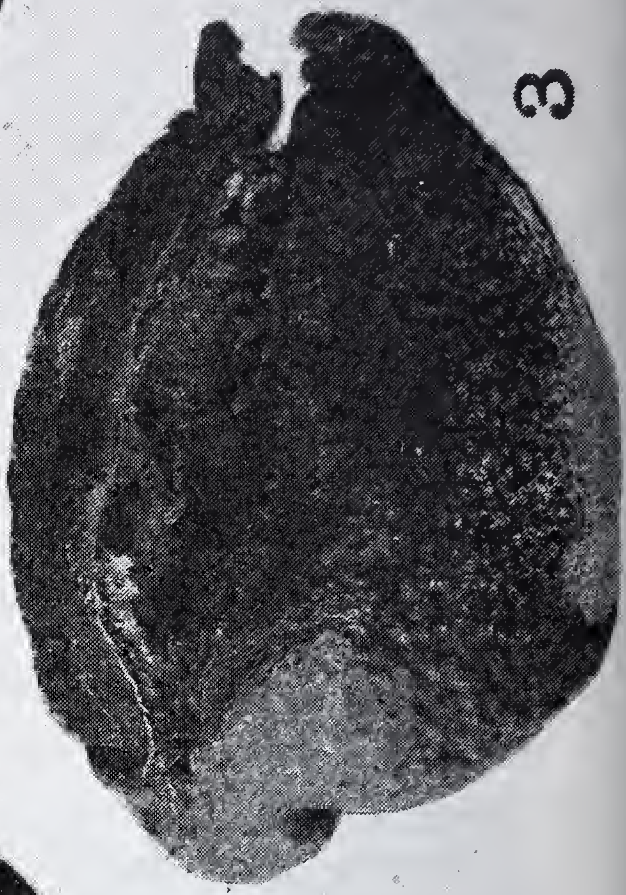

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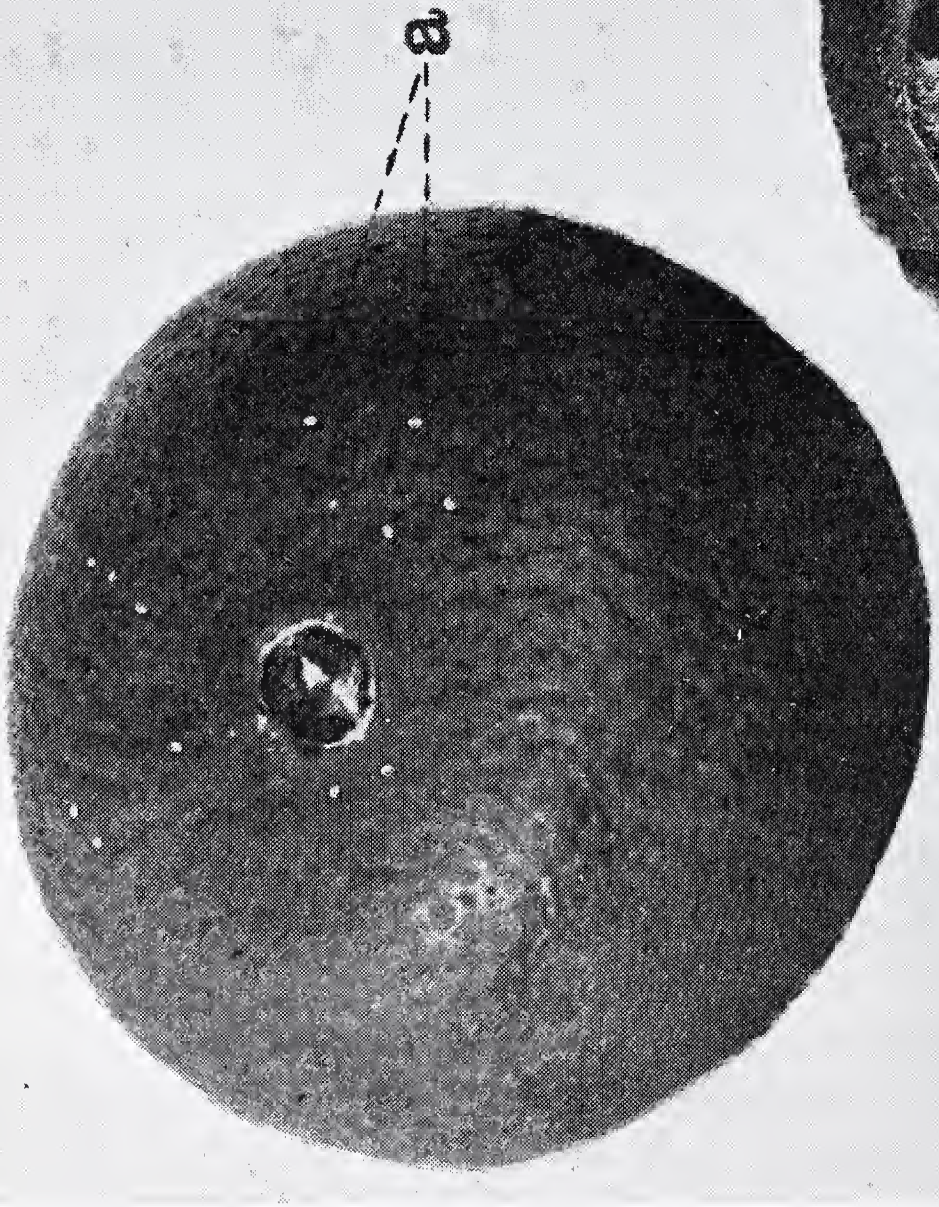

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lemon was split, had fallen on the ground and was partially decayed by parasitic rots. (Plate VII, Fig. 3.)

Lemons seldom split or are bruised and thus are not usually affected with the Black Rot.

Several injured grapefruit have been found containing very small larvae and also with eggs. Two grapefruit were found by the writer which were attached to the tree, and fifteen eggs were deposited near the bruised and cracked portion. A limb of the tree had rubbed against them until they were bruised and the wound had dried and hardened. Splitting then occurred. (Plate VIII, Fig. 1). No adult larvae were ever found in a grapefruit, or have moths ever been reared from them.

Since the rind of the grapefruit is thick and smooth, and seldom cracks open, rot is negligible. Only where a sapsucker has made a puncture or the fruit has been injured on lower limbs by cultivators, does the rot enter, and on such fruit are frequently found eggs of *M. venipars.*

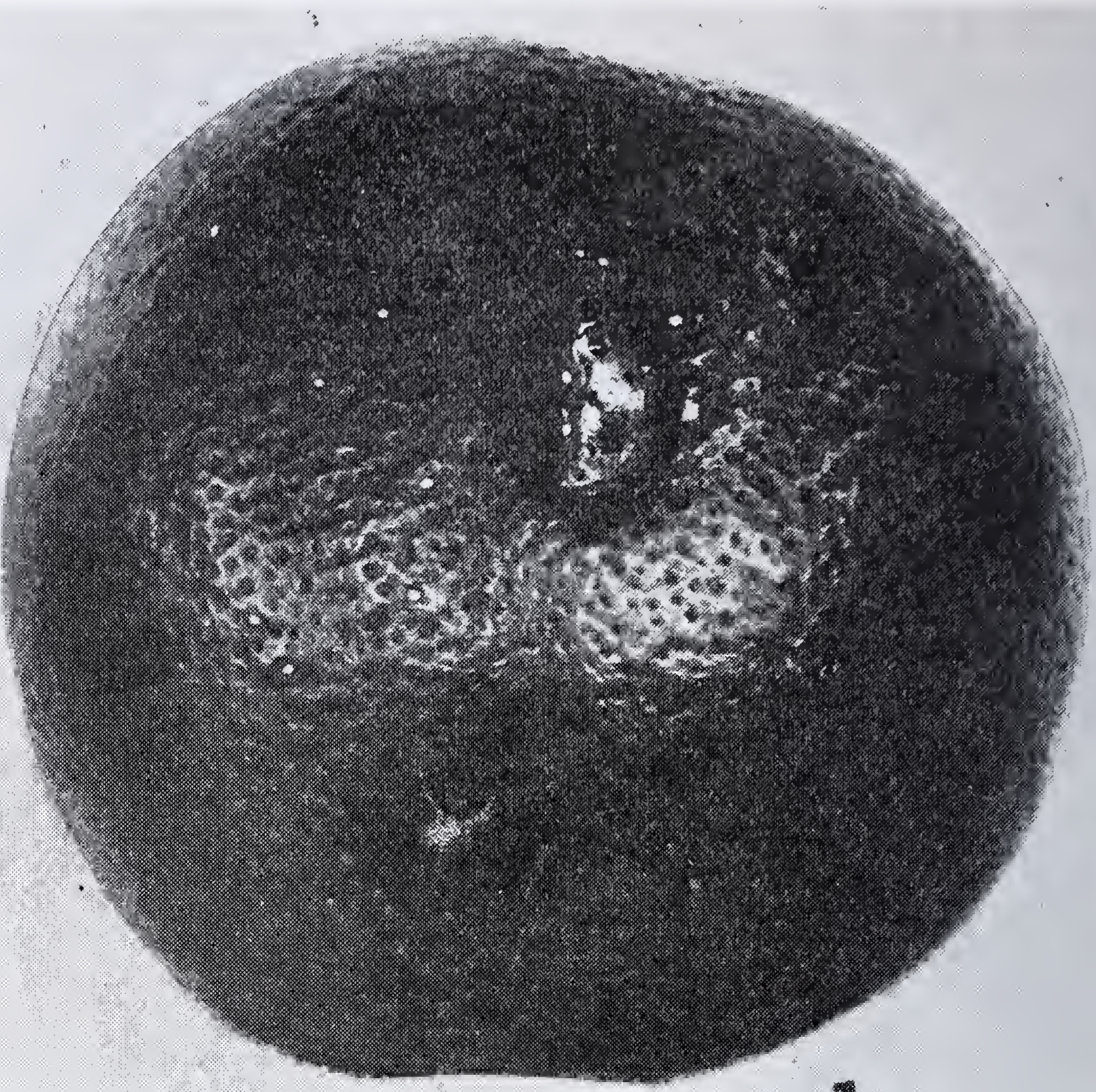
Don C. Mote in his paper on the "History of Myelois venipars in Arizona" makes a statement in connection as to whether or not this insect precedes the rot or whether the rot precedes the insect, adding that Mr. R. S. Wolgum, who collected the insects from which the original description was made, has a bearing upon this question. The insects collected by Mr. Wolgum were taken from oranges on the ground in the vicinity of Hermosillo, Mexico, and no particular importance was attached to the occurrence at that time, it doubtless being assumed that this was one of the many insects which feed upon decayed fruits after the fruits have fallen from the trees. In correspondence with Mr. August Busck, concerning the food plants of this insect, Mr. Busck furnished the following statement:

> "Food-plant of *Myelois venipars* Dyar is given merely as Orange. *M. sporedestella* Dyar was bred from 'Dry Loquat fruit'. The European *M. cribrella* Hubner feeds in heads of thistle, but also on Lappa (*Compositae,* Burdock), Echium (*Boriginaceae,* Borage), etc. The European *M. ceratonial,* Zeller, feeds in the seeds and pods (dry) of Robinia (*Leguminosae,* locust), Castanaea (*Cupiliferae,* chestnut), etc. Probably they are all—as is common in the family Phycitidae—more or less scavengers, though each species may be attached to certain plants."

Types of Oranges

There are several distinct types of inferior oranges on which eggs or in which larvae or *Myelois venipars* may be found. Plate

PLATE VIII.



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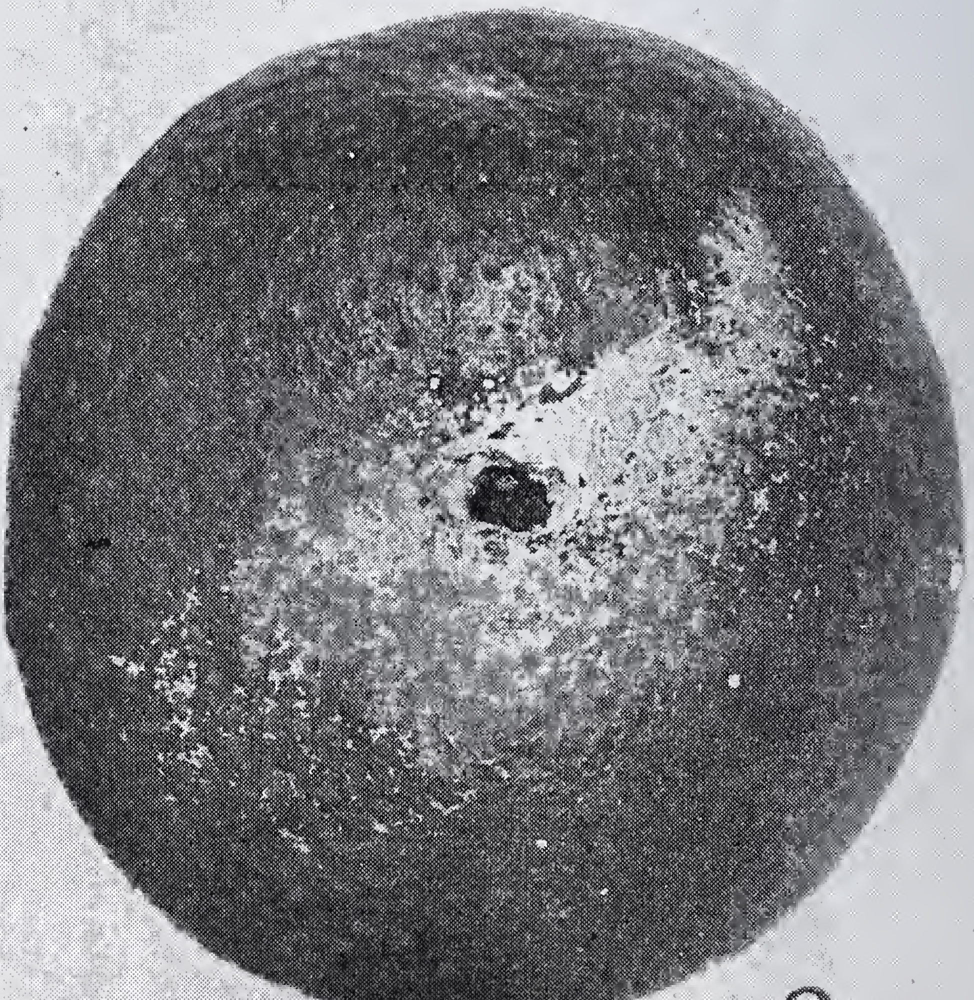

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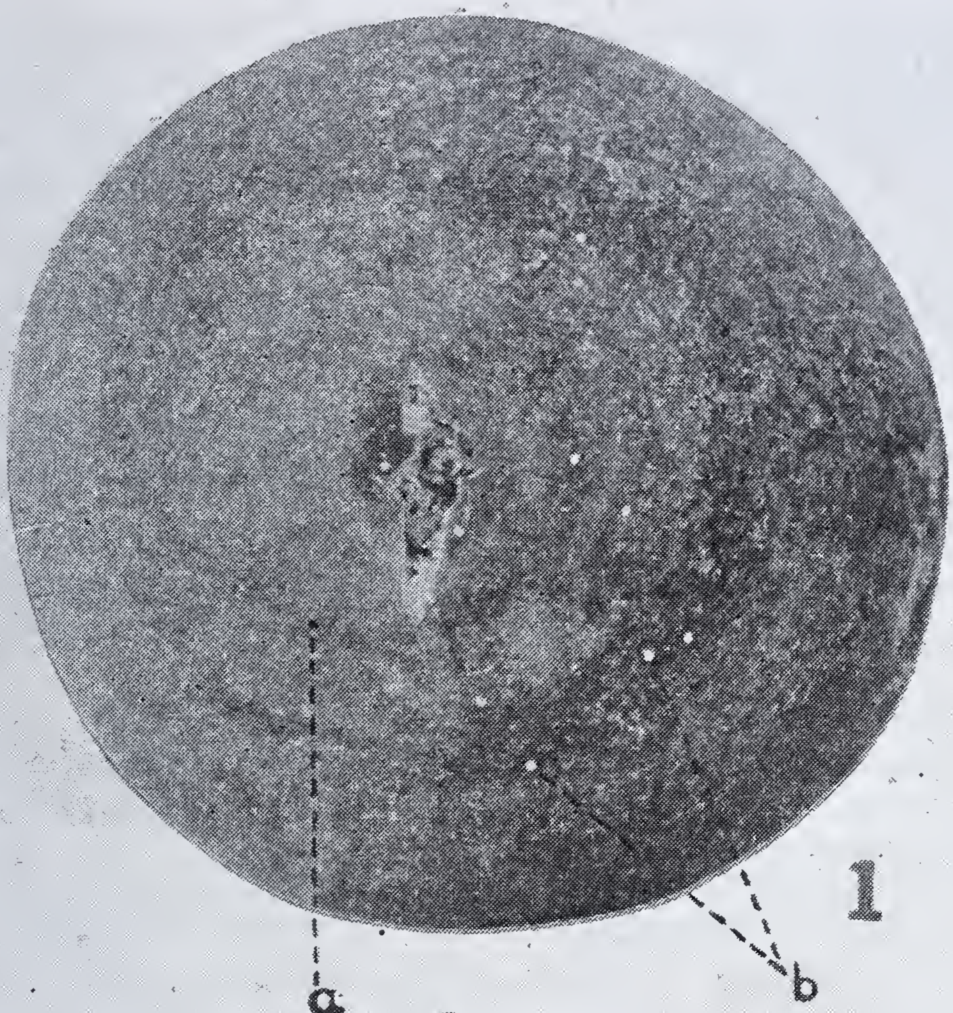
1. Injured grape fruit showing eggs of M. VENIPARS in region of injury.
2. Orange punctured by Gila Woodpecker, showing eggs in vicinity of injury.

PLATE IX.



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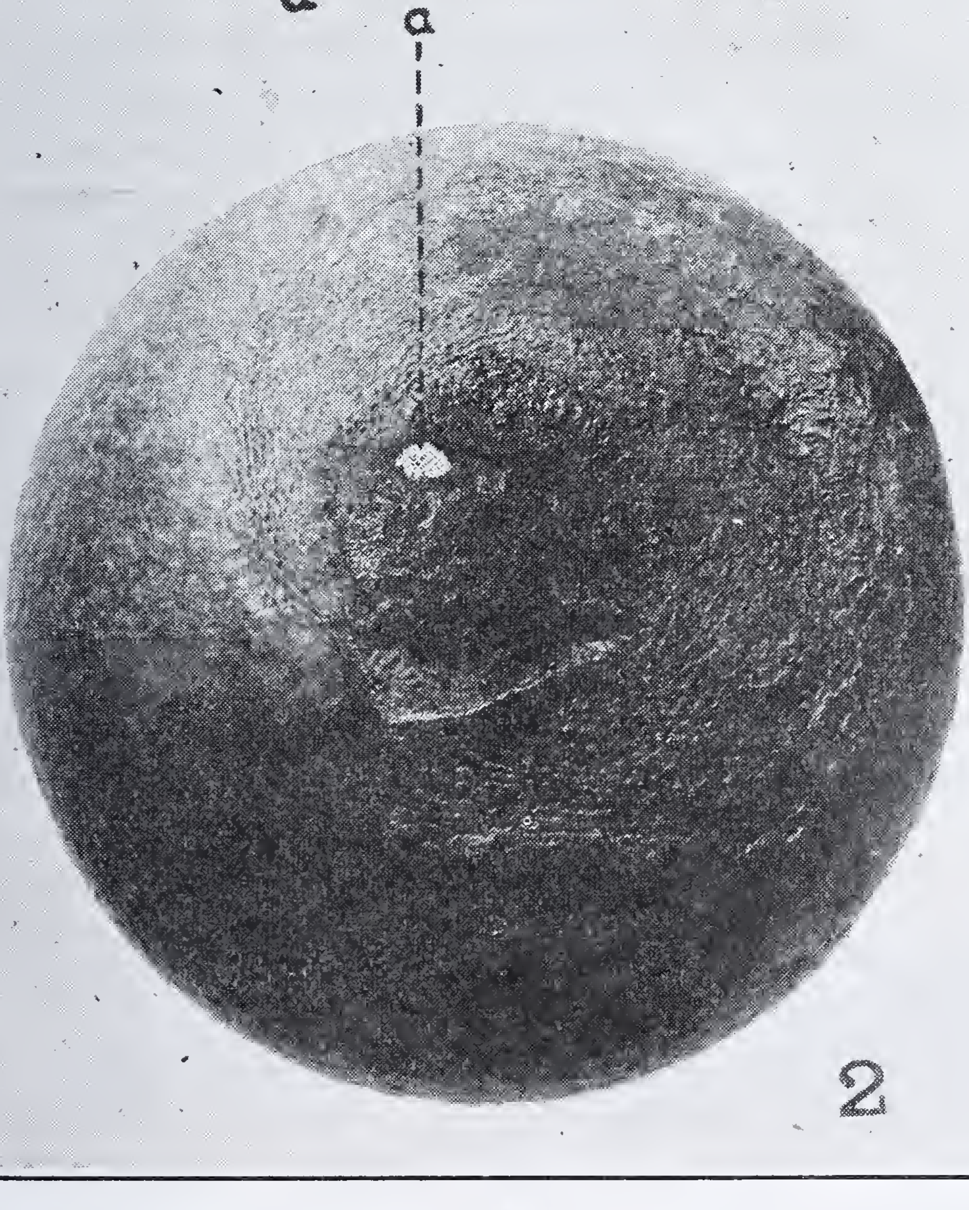

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1. Orange partially decayed by Black Rot (ALTERNARIA CITRI). a, parasitized egg; b, normal eggs.
2. A partially decayed orange caused by Black Rot. a, exit hole for emergence of M. VENIPARS.

IX, Fig. 1, represents an orange in which the Black Rot has become firmly established, with the blossom end of the orange encircled with the fungus. The navel end had split and had become dried. On the surface near the navel end and approximate to it eggs were deposited. (Plate IX, Figs. 1, b.)

Another type of orange on which the eggs may be deposited is on oranges which have been punctured by woodpeckers. In several groves in the Salt River Valley some damage was caused by several species of woodpeckers, especially Gila woodpecker (*Melanerpes uropygiallis*). Punctures were made in the sides of the oranges and grapefruit. Such fruit serve as an excellent opening for *Alternaria* rot and a place to be selected by the moth to deposit her eggs. (Plate VIII, Fig. 2.)

Split oranges possibly furnish the greatest number of places for infection of *Alternaria* rot, and for the oviposition of *M. venipars*. Splitting occurs almost entirely among navel oranges. Along the margin of the split or on the sides of the opening, eggs are frequently found. Larvae were abundant in split oranges.

Some oranges are found seemingly in good condition except for the dry navel end. In this type the navel is usually very much dried. On such oranges eggs may be found and the larvae are able to gain an entrance through the dried tissue. (Plate VII, Fig. 1.)

Another type is that in which the navel end may split in a circular outline, drawing itself to one side. During the summer and early fall such oranges escaped as places for oviposition. (Plate VII, Fig 2.)

Eggs and larvae may be found on and in oranges which are apparently perfect but which may be highly colored, due to infection by *Alternaria*. The rot apparently softens the peel in the region of the navel end and the newly hatched larvae may then be able to burrow through.

Importance

In so far as our observations and investigations have extended, very limited definite proof can be advanced to support the statements that *Myelois venipars* is a primary pest of oranges. During writer's survey, extending from the period of October 1, 1922, to February 1, 1923, not a single saleable orange has been found with eggs deposited on the rind or larvae within. However, a few apparently perfect oranges containing larvae or eggs were found by the authors earlier in the season. In a few rare instances eggs were found upon oranges with apparently perfect navels by the senior author. However, no larvae ever developed in these oranges.

Newly hatched larvae have never been found to enter through the perfect rind of the orange. The apparent necessary requirements seem to be an imperfect orange caused by split, wound, parasitic or saprophytic rots.

In only a few ways are the habits of *M. venipars* similar to those of the Codling moth. The following comparison may be noted.

Arizona Navel Orange Worm	Codling Moth
1. Eggs laid on developed injured fruit.	Eggs on calyx, leaves and fruit.
2. Young larvae enter injured portion of fruit.	Larvae enter through Calyx or direct through skin of perfect fruit.
3. Young larvae prefer dried portion of fruit first.	Young larvae may eat leaves or healthy fruit tissue.
4. Young larvae remain in damaged fruit to pupate.	Larvae leave fruit and pupate outside.

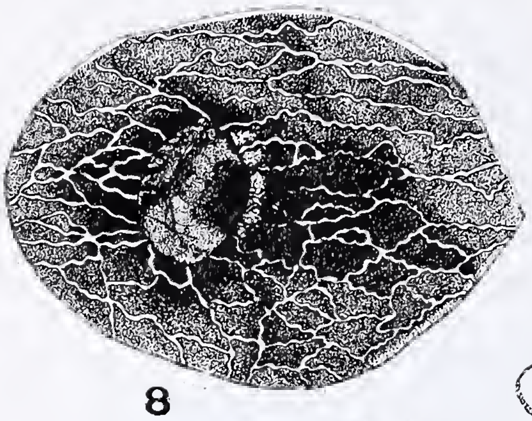
The Codling moth definitely injures the perfect fruit while the Arizona Navel worm does not, except in a few rare cases.

Since the larvae can only be found associated with rot or injured fruit it may be reasonably concluded that it is a secondary pest.

If the *Alternaria* rot was found in oranges with the larvae and in injured fruit without larvae, then it might be assumed that the larvae caused the damage through which the rot entered. The *Alternaria* rot, however, is found, as has been stated, in oranges apparently perfect in which no larvae have been found and its entrance therefore cannot be attributed to Myelois larvae. Therefore to consider *M. venipars* a primary pest cannot be substantiated from the observations made by the writer and investigators. However, if no measures were taken in checking the increase of larvae, under unusual circumstances the larvae might possibly increase so rapidly that there would be insufficient injured fruit for them to feed on. The young larvae might become either resistent to the oily rind, or its mandibles become more powerful and in time be able to enter a perfect orange.

Laboratory tests consisting of the transfer of newly hatched larvae to perfect oranges have shown that the larvae fail to enter

PLATE X.



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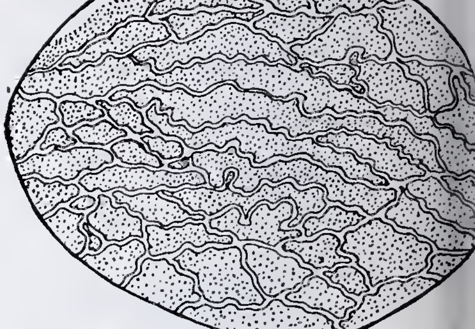

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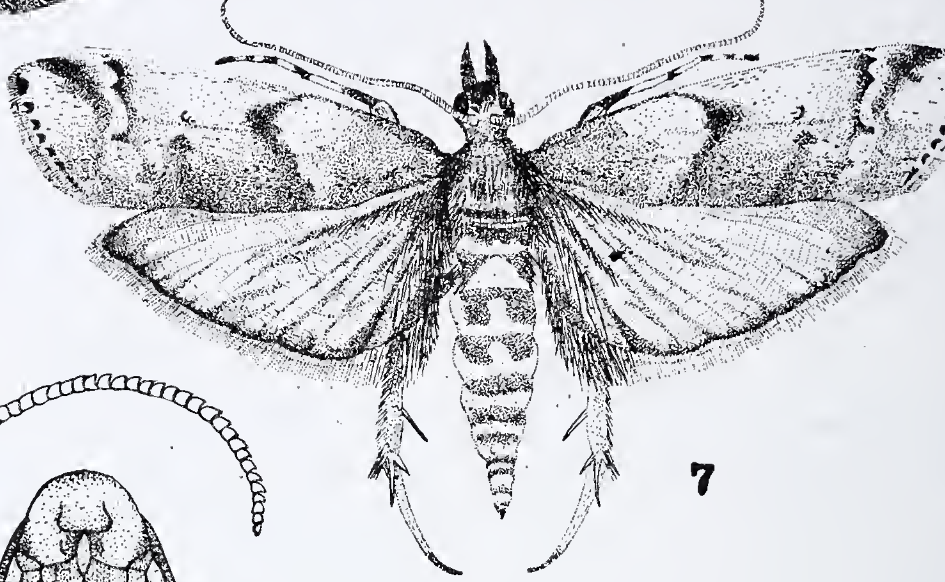

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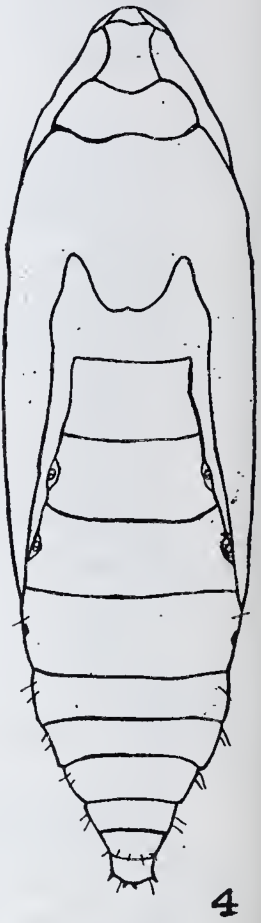

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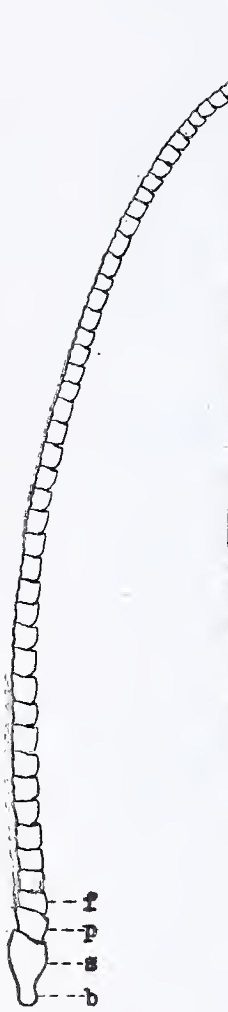

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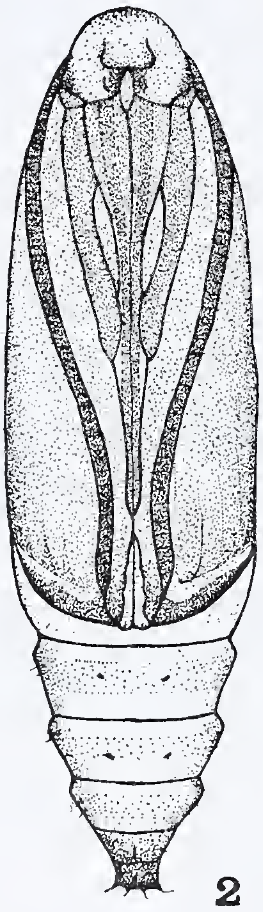

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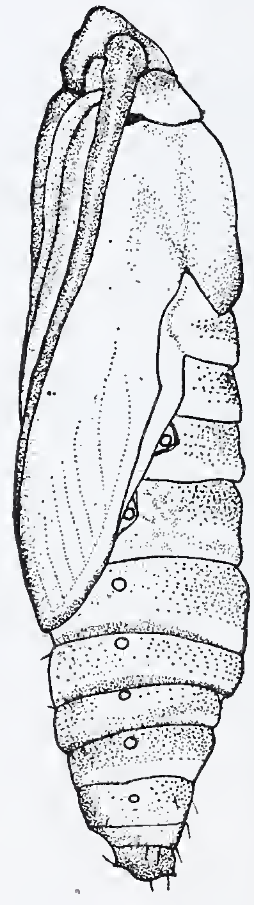

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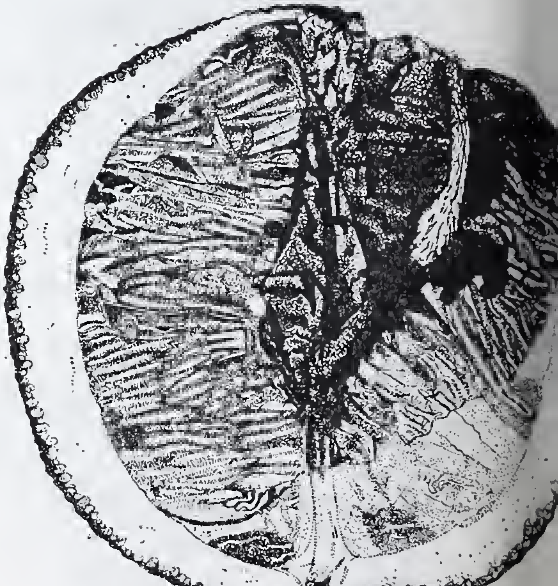

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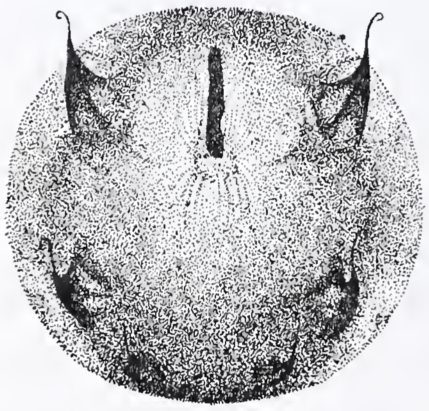

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Drawings by P. A. Glick.

EXPLANATION OF PLATE X.

Life Stages of Myelois venipars Dyar

1. Egg. X 50.
2. Ventral aspect of pupa. X 5.5.
3. Lateral aspect of pupa.
4. Dorsal aspect of pupa.
5. Caudal aspect of last abdominal segment of pupa. X 25.
6. Antenna.
7. *Myelois venipars* Dyar (female). X 3.6.
8. Parasitized egg showing exit hole of parasite.
9. Cross section of orange showing position of cocoon. Slightly reduced.

the oranges and complete their development. However, it cannot be assumed that an adult larva or even partly grown larva, if given a chance would not burrow through the peel of a perfect orange. E. V. Walter of the U. S. Entomological Laboratory at Tempe, Arizona, has noted an adult larva to burrow through the fresh peel of an orange. Since the more developed larvae are able to enter through the perfect peel, it might be assumed that the oil contained in the orange was not a repellent but merely that the mandibles of the newly hatched larva were not strong enough to burrow through the thick rind. If the oil did directly prevent the young larva from burrowing through the peel, then the adult larva are vigorous enough to resist the oil. The subjection of the young larvae to extracted oil of the peel has not been tried to learn the results.

Fortunately there is a check on the possible habit of the adult larvae burrowing through the orange peel. The larvae never come out of the orange once they are estalished in the orange. This eliminates the danger of the larvae crawling from one orange to another. Larvae will readily eat good oranges if placed in them, and if it were not for the fact that nature providing the orange with the natural repellent of the oily skin (if it does act as a repellent), and the thickness of the rind, the larvae would possibly be a pest of some importance.

Control

In the past year the growers were urged to destroy all oranges found upon the ground either by burning, boiling or burying them. It is believed that the picking up and destroying of fallen fruit is an essential to good orchard practice and is well worth the time devoted to it, by reason of the fact that such a procedure rids the orchards of diseased or pest invaded fruit.

Life History

THE EGG. The shape of the egg is ovate. As viewed upon orange, the surface is flattened. When first deposited the color is of a pearly lustre to milky white. In a day or two, due to the development of the embryo, the egg becomes pinkish to reddish in color. There are numerous ridge-like transverse markings over the upper surface usually lighter in color than the ground color of the egg. The border of the upper surface of the egg overlaps the orange peel, and thus helps to glue the egg more firmly to the orange. Length .8 mm. to 1.0 mm.; width .58 mm. to .7 mm. (Plate X, Fig. 1.)

Many eggs are found almost black in color, which color is associated with the attacks of a small parasitic hymenopteron. (Plate X, Fig. 1.)

From the observations in 1921 it was suspected that the eggs were deposited on the orange, and this supposition was verified August 4, 1922, when Utilis Russell brought several injured oranges with small objects on them which he thought were eggs. These were examined by Mote and were verified as eggs of *M. venipars*, since they were similar to eggs obtained from moths in the laboratory the previous year. Eggs have been found in the field as late as November 20. The maximum abundance is during September to the middle of October.

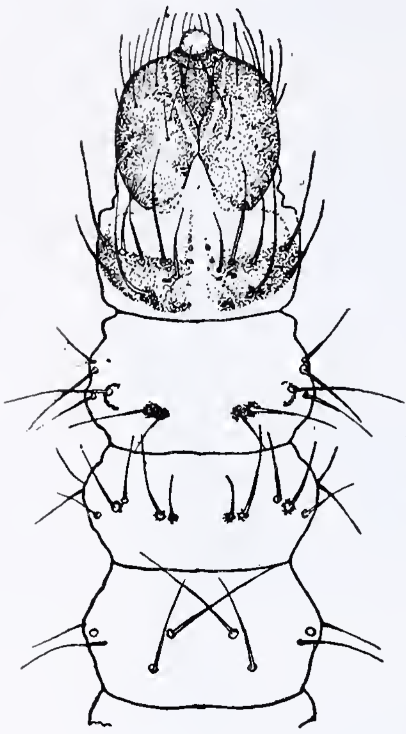
The period of incubation has been stated as four days, although, since no fertile eggs have been obtained in the laboratory, and no exact records of oviposition obtained in the field, no definite statement can be made upon the length of incubation. Eggs found in the field which may have been deposited the night before hatched within four days, others from five and six days. In the laboratory, Gates, O'Dell and the writer obtained infertile eggs on the sides of glass vials and on split oranges and orange leaves.

Places of oviposition have been discussed.

LARVA. The description of the larva follows: Head capsule. Front dark brown with adfrontal area lighter. Vertex light brown in color mottled with darker irregular blotches. Adfrontal suture very light, slightly curving mesad and then recurving slightly laterad until it reaches the lateral edge of post-clypeus. Adfrontal suture at meso-cephalic margin very light in color, widening irregularly laterad, and much darker brown in color surrounding this area. Epicranial stem not as evident as arms and disappears at meso-cephalic aspect of vertex. Epicranial arms widely curving laterad and recurving mesad near frontal setae and ending at pretentorina. Post-clypeus and preclypeus semi-transparent, with setae very dark. Mandibles chitinized. Maxillary palpi and labial palpi very light in color, almost white, with long setae. Ocelli 1, 2, 3, 4, and 6 very dark. Ocelli 5 very light in color. Setae scattered over doso-caudal aspect of vertex and front. Two pairs of adfrontal setae, the first pair situated by the division of the epicranial arms. One pair situated caudad of former pair. Adfrontal punctures evident. One pair of medium long frontal setae. Frontal punctures evident. Three pairs of setae on frontal-clypeal suture. Labrum with three pairs of very short setae, on caudal margin. Several pairs of genal setae. Length, 1.4 mm. to 1.51 mm.; width, 1.3 mm. to 1.38 mm. (Plate XI, Figs. 5 and 6.)

A few specimens are slightly darker.

PLATE XI.



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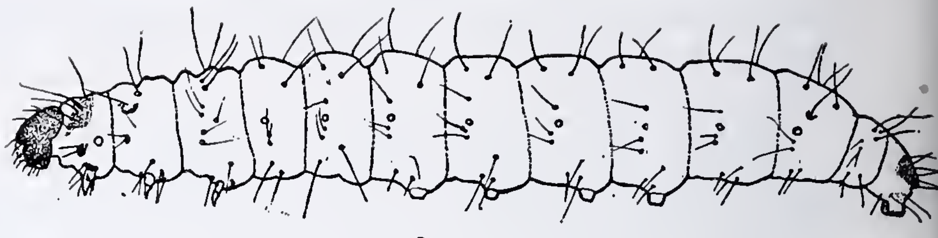

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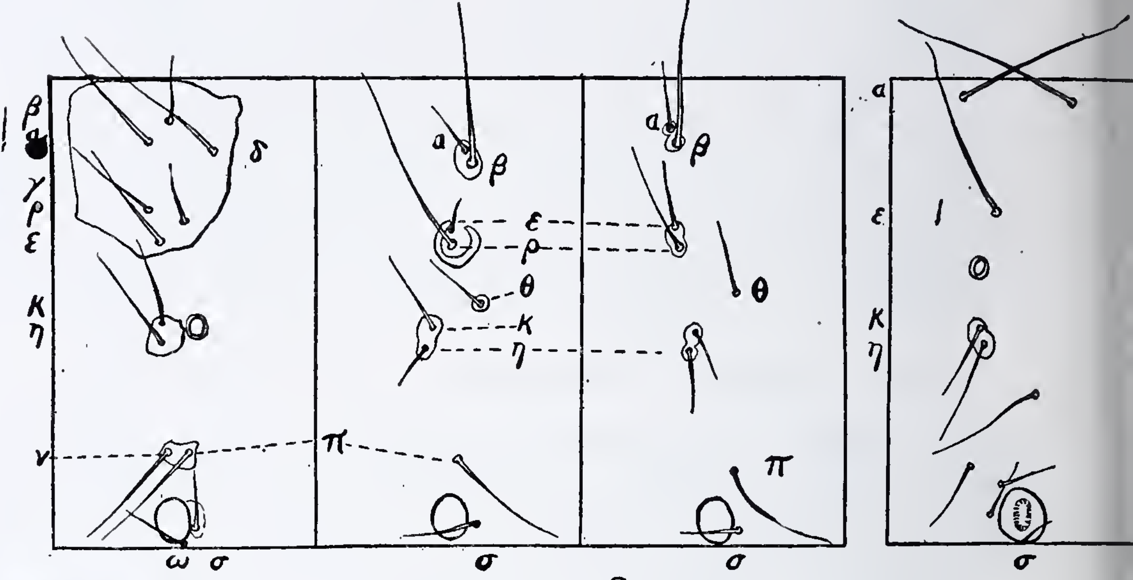

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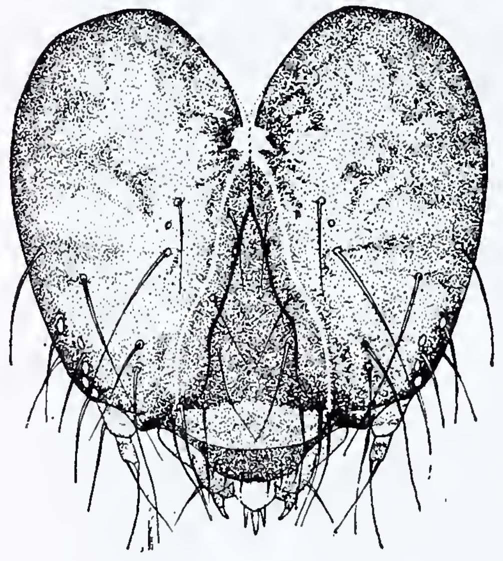

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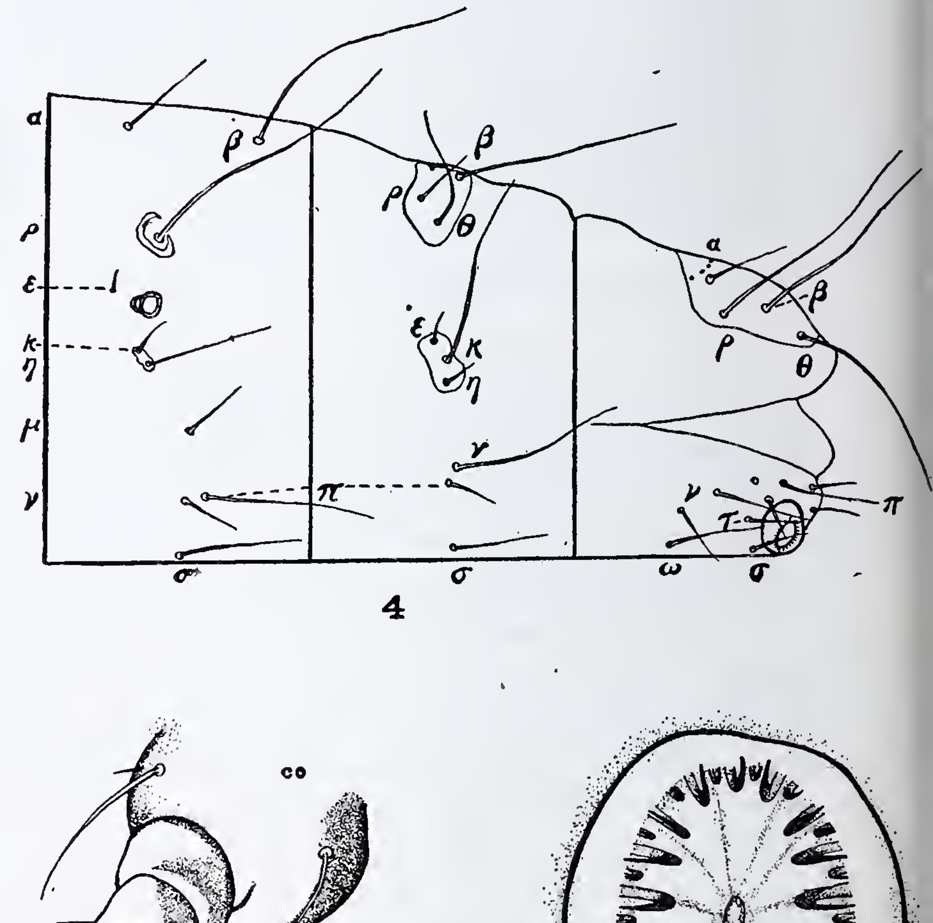

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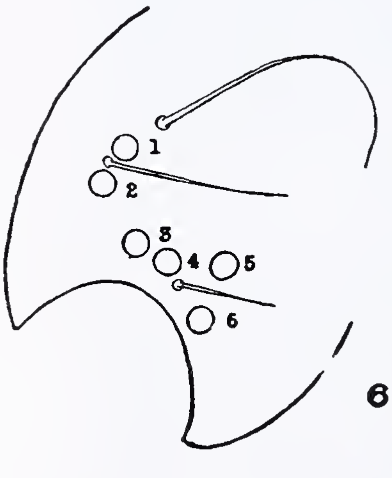

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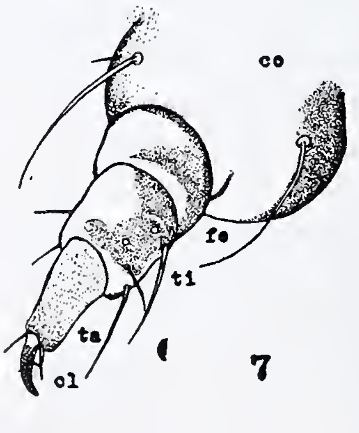

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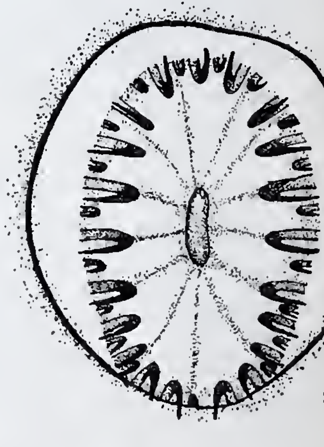

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Drawings by P. A. Glick.

EXPLANATION OF PLATE XI.

1. Adult larva of *Myelois venipars*. X 3.5.
2. Head and thoracic segments of adult larva.
3. Setal map of thoracic and III abdominal segments.
4. Setal map of VIII, IX and X abdominal segments.
5. Head capsul of adult larva.
6. Ocellar group.
7. Metathoracic leg of adult larva. co, coxa; fe, femur; ti, tibia; ta, tarsus; cl, claw.
8. Ventral aspect of proleg, showing biordinal arrangement of crochets.

Thoracic and abdominal segments.* DORSAL ASPECT. Prothorax: Prothoracic shield very dark brown in color, divided on meson, division wider caudad. The color becomes indistinct cephalid. Six pairs of rather stout setae and several pairs of setigerous punctures. Seta *rho* is the shortest and *delta* the longest. Setae (*kappa* + *eta*) situated cephalo-laterad of spiracle. Setae (*nu* + *pi*) present.

Mesothorax much lighter, the setae (*alpha* + *beta*) situated in a small dark area. Setae (*epsilon* + *rho*) with a semi-circular dark area surrounding them. Setae *epsilon* very minute and *rho* very long. A dark colored area surrounding the setae (*kappa* + *eta*). Seta *pi* long. Metathorax similar to mesothorax except setae (*epsilon* + *rho*) situated in a small dark colored area. Setae present on all the abdominal segments as is shown in Plate XI, Fig. 3.

VIII abdominal segment with a semi-circular dark band surrounding seta *rho*. Setae (*kappa* + *eta*) set in a dark area. Setae (*rho* + *beta* + *theta*) also situated in a dark area. Setae (*epsilon* + *eta*) very short, *kappa* longest. These setae also situated in a dark area. Last abdominal segment with setae (*alpha* + *rho* + *theta* + *beta*) in a large dark area. A row of setigerous punctures extending across meson from setae (*alpha* to *alpha*). (Plate XI, Fig. 4.)

Ventral aspect. Thoracic legs slightly darker, with a wide dark semi-circular band at base. (Plate XI, Fig. 7.) Seta *omega* on prothorax and on last abdominal segment. Seta *sigma* present on all segments. Setae (*sigma* + *tau* + *pi*) surround last abdominal proleg. (Plate XI, Fig. 4.) Crochets of prolegs ranging from 31 to 40 in number. Crochets biordinal. (Plate XI, Fig. 8.) Length of larva, 17 mm. to 20 mm. Width at III abdominal segment 4.5 mm.

The general ground color of the larva is lemon yellow to orange but frequently varies according to the food eaten. If the larva feeds on an orange with considerable rot (*Alternaria citri*), it will be black in color or light gray.

The larvae occur throughout most of the year and are most abundant during the late summer, fall and early winter. From December to February the larvae were abundant ranging from the probable second instar to the last instar. Toward February adult larvae were more frequently found.

No cannibalistic tendencies have been observed. If the larvae are disturbed by opening the orange or cocoons they become active and seek concealment by burrowing within the orange or crawling over the surface. Since they resemble the color of their surroundings they might be at first overlooked, as in the Black Rot they are usually very dark, and become lighter if the rot is less.

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*Description of setae according to method used by Dr. S. B. Fracker, in the "Classification of Lepidopterous Larvae."

PUPA. DORSAL ASPECT: The thoracic segments are very dark brown in color with sutures very evident. Mesal ridge evident. Thoracic segments bare of setae. Abdominal segment VIII with a pair of setae having very evident tuberculiform bases. Two pairs of setae situated on IX abdominal segment, along caudal margin. Setae uncinate at apex. Last segment considerably rounded. Abdominal segments coarsely punctate. (Plate X, Fig. 4.)

Lateral aspect: Spiracles very evident. II and III abdominal spiracles very large. VIII abdominal spiracle smaller. (Plate X, Fig. 3.)

Ventral aspect: Front rounded. Clypeus rather broad. Pretentorinae evident. Labrum broad. Profemur very light in color. Prothoracic legs slightly darker. Mesothoracic legs extending to middle of IV abdominal segment, converging, but widens again laterad. Metathoracic legs very light in color, extending slightly beyond mesothoracic wings. Abdominal segments very much lighter in color and sparingly punctate. VIII, IX, and X abdominal segments gradually become darker with the X segment very dark. Two pairs of finely curved setae situated latero-ventrad of meson on VIII abdominal segment. One pair of minutely curved setae just laterad of meson on IX abdominal segment. Genital openings very evident. Annus evident, being black in color. Last abdominal segment with one pair of setae directed caudo-ventrad, with prominent tubericuliform bases, at the apex of which rises minute setae uncinate at end. One pair of similar shaped setae, slightly smaller, dorso-cephalad of the former. One pair of setae situated just laterad of meson on dorsal margin of segment, with elevated basis. (Plate X, Figs. 2, 5.) Ground color light brown. Head and thoracic segments darker in color, except the last three abdominal segments. Length 10 mm. to 12 mm.; width 2 mm. to 3 mm.

The cocoon is very characteristic. It usually occurs near the rind of the orange horizontal or perpendicular to the core. (Plate X, Fig. 9.) If the orange is not split and the rind much hardened the larva eats a circular hole through the surface of the rind, to which it attaches the slender neck of the cocoon. (Plate IX, Fig. 2.) The cocoon is elongate-cylindrical and the caudal portion of it may extend for half an inch from the exit of the cocoon. The cocoon is bulbous at the caudal end and contains the pupa. This elongation serves for the exit of the moth through the tissue of the orange. Cocoons found in hard dried oranges on the ground may lack this elongation. Several cocoons were found on the outside of oranges, placed in the rearing cages, and these lacked the elongation. When the larvae were placed into vials the elongation of the cocoon was retained. On January 23, one cocoon was found fastened to the outside of the orange, containing a full grown larva. This was the only instance of the larva recorded in the field having been found outside of the orange. It was made on the side of the orange next to the ground and was matted with dirt and leaves.

Dirt and frass usually cover the cocoon although a few were entirely free of any outside dirt, leaving a clean white silken appearance.

The winter cocoons are heavy and coarse while those found during the summer and early fall, especially in the oranges on the trees are very flimsy and the pupa may be easily seen through the silk.

It was found that adult larvae removed from hibernation in dried oranges or full grown larvae from feeding, would usually pupate within two or three days, in vials. These larvae invaribly spin their silken cocoons whether they pupate soon after or not.

Pupae occur in oranges on the trees which are split, wounded, affected with the rot, or with the navel end very much dried. During the winter all pupae were found in oranges on the ground. They occur in summer, fall and winter.

THE ADULT. *Myelois venipars* was described by Dr. Harrison G. Dyar in 1914. His description follows:*

"Costa a grey-white; inner area broadly pale brownish; inner line black, broad, curved a little and widening to median vein where it is sharply cut off and continue to margin by a faint brown shade; discal dots black, separate; median vein outwardly, with veins 2, 3 and 4, distinctly black-lined to outer line; a slight shade from cell down to margin near middle; outer line far out, in-angle opposite cell, double, pale filled, narrowly followed by black at costa; terminal space faintly blackish streaked on the veins; terminal dots small, distinct. Hind wings translucent, soiled whitish, veins darker, margin fuscous shaded; fringe pale with faint dark interline. Expanse, Male, 16 mm.; female, 19 mm.

Co TYPES—male and female, No. 18208, U. S. N. M.; male Oaxaca, Mexico (Schaus collection); female, Hermosillo, Mexico, bred from orange, November 2, 1913 (R. S. Wolgum).

Sir G. F. Hampsen has determined the male as *Myelois solitella* Zeller, but after studying Zeller's description and figure and Raganot's re-description of that Colombian species, I feel satisfied that it is not the one before me. The present species is close to *M. transitella* Walker, but differs most in the dark lines on the discal nervules."

The color and markings of both male and female moths vary widely. Hardly two individuals are alike. The markings on a few are very pale, merely dull gray, while others are very contrasty, with deep black and white. The hind wings vary from almost pure white to dull gray in color. In a few specimens the upper wings are more narrow. All moths collected during the survey are larger than Dyar's specimens for his descriptions. The males measure from 17 mm. to 21 mm.; females from 18.5 mm. to 23 mm. According to Dyar, our specimens are larger, grayer and less ruddy than those from Mexico and Guatemala in the National museum. (Plate X, Fig. 7.)

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*United States National Museum Bulletin, No. 2054, Vol. 47, Page 404

Adults live from three to ten days in captivity although in the field length of life may extend over a longer period. They do not seem to care for food, especially while they are resting during the day as they have not been observed to take food.

Moths were never observed in the field by the writer or others of the survey.

Gates in his notes, states that he found them common in the trees during the day, and could be easily disturbed by shaking the trees. This could not be substantiated. However, a number of adults have been taken by trap lights set in the orange groves.

Moths emerged throughout the winter in the laboratory. In cages containing infested oranges kept under natural conditions, moths emerged throughout January and February.

Only one authentic record of the existence of *M. venipars* prior to July, 1921, can be found in Arizona. The United States Entomological Laboratory, at Tempe, Arizona, has on record one specimen taken in a trap light October 4, 1920, which was not determined until the following summer. Growers have stated that the larvae of the moth has been known in the Salt River Valley for many years, with three periods of maximum abundance. Since the Black Rot has been common in the Valley for thirteen years or more, there is a possibility of the growers associating this damage with that of the larvae. Frank Todd, Assistant Entomologist, Yuma, Arizona, states that he found one larva in an orange, after examining innumerable oranges in groves around Yuma.

At the beginning of the survey of the Arizona Navel Orange Worm, the exact damage caused by the larvae was not known. Realizing California's valuable citrus industry it was considered advisable to notify the California authorities. Accordingly on October 17, 1921, Director Geo. H. Hecke, Department of Agriculture, Sacramento, California, was notified of the finding of the larvae. Later Lee A. Strong, Chief Quarantine Officer, California Department of Agriculture, made an inspection trip for the purpose of investigating the situation. On his return California authorities issued instructions to all quarantine inspectors and quarantine guardians in California to refuse entry all navel oranges arriving in California from Arizona points.

It has not been determined as to the distance a moth is able to fly or whether it has a tendency to migrate. In one grove completely isolated from groves within several miles, the larvae were found to be very abundant. Since the larva remains in the orange until it emerges as a moth, there is a possibility of the larva being disseminated long distances by the removal of infested oranges that may be apparently "passable."

Natural Enemies

Parasitism in the larvae has not been observed. The egg is the only stage where parasitism has been noted. On oranges containing as many as twenty to thirty eggs, frequently three-fourths of the total number are parasitized.

The parasitized eggs are very dark, almost black in color, and when the small hymenopteron or four winged fly emerges from the egg, a small circular hole is made, slightly excentric. (Plate X, Fig. 8.)

When the larva hatches from the egg a hole is eaten through the shell at the extreme end of the egg. This small fly is undoubtedly the greatest check upon the increase of this insect. Earwigs (Forficulidae) are found commonly in damaged oranges, and since they are predacecous probably eat numbers of larvae of *M. venipars.* The actual eating of larvae by earwigs was never observed, although a partially eaten pupa was found in an orange containing an earwig. The pupa had evidently just been attacked. Ants also are found abundantly in oranges and may attack larvae and pupae. Another insect very similar to an earwig in appearance, with the exception of the pincer-like appendages on the end of the abdomen (circi), is found commonly in oranges. These insects (Embiidae) are predaceous and also possibly eat the small larvae.

Summary

1. A survey was made of the Arizona Navel Orange Worm, extending from July, 1921, continuing up to the writing, or March, 1923.

2. The larvae are found associated with injured fruit of navel oranges, which are their primary food.

3. Several injured grapefruit were found with eggs and very small larvae. No full grown larvae have ever been found in a grapefruit. One split lemon was found with an adult larva. One sour orange, partially decayed by parasitic rot was found containing a larva.

4. Eggs have been found on two perfect navel oranges, thus showing such cases were extremely rare. Larvae never developed in these oranges.

5. Newly hatched larvae have not been observed to enter the perfect orange.

6. Moths apparently prefer injured fruit for oviposition.

7. Larvae were found in navel oranges which might have been saleable, had not the larvae caused further injury. Such cases were rare.

8. Adult larvae are capable of burrowing directly through the perfect peel of the orange.

9. The larva never leaves the orange, except when it emerges as an adult.

10. A parasite (Hymenoptera) destroys probably seventy per cent of the eggs of the moth.

11. Oranges on the ground should be collected and destroyed.

12. From the investigations, it is considered that the Arizona Navel Orange Worm is a secondary invader of navel oranges.

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PART V.

NOTES ON PLANT DISEASES IN ARIZONA, 1922

By

D. C. GEORGE

The accompanying notes on the plant diseases of Arizona for the year 1922 by no means covers the field of plant disease parasites found on the vegetation throughout the State. Those of major economic importance and some new to the State which have a relationship to the agricultural industry are given brief mention.

No attempt is made to list or determine all the maladies which are usually termed physiological, nor will the disturbances caused by climatic conditions be given anything but minor consideration. The information has for the most part been obtained from the Arizona Crop Pest inspectors stationed throughout the State, the Field Scouts employed in scouting work during the summer months, and members of the staff of the State Entomologist's Office.

The major portion of the notes are from collections and personal observations made by the writer. Several field trips made during the season into the various agricultural districts of the State, enabled a better acquaintanceship with the various plant diseases present. One of the most important of these was an extended trip into the agricultural regions of Navajo and Apache Counties, under the direction of C. R. Fillerup, County Agricultural Agent. According to Mr. Fillerup, this was the first time a plant pathologist ever visited these districts, therefore some mention will be made of the chief diseases prevalent.

Plant Diseases New to Arizona

In the early spring, April 13, there was brought to the office of the Plant Pathologist some orange rust (*Gymnoconia interstitialis*) taken from some blackberry plants belonging to a large grower, who resides about seven miles north of Phoenix. The entire leaf surface upon the under sides was densely covered with the orange colored spores so that the diseased plants were very conspicuous. According to the grower only four plants in his entire planting were attacked by the disease. These plants were among a large number imported from a Texas nursery early in the spring of 1921 and in all probability became infested prior to their shipment into Arizona. All of the plants showing the disease were taken out and burned, and later inspections indicated no further spread of the rust. So far as can be learned this is the first appearance of this disease in Arizona.

A root and stalk disease of field corn, which is probably new to Arizona was observed for the first time on July 28, in a field about two miles south of Phoenix. Specimens were first brought to the office of H. C. Heard, County Agricultural Agent for Maricopa County, who referred them to this office. A trip was made to the field and the disease examined under the existing conditions. No general destruction of plants was found nor was there any particular spot showing many diseased stalks. An infected plant could readily be noticed by the dried or wilted condition of the upper leaves which caused them to be conspicuous among the surrounding healthy plants. Such plants revealed a water soaked constricted area, dark brown to blackish in appearance, just below the soil surface. When handled the stalks readily broke at this constriction and a very strong odor of decay was noticeable. A few plants had dropped to the ground because of the weakened condition, but the greater majority still maintained the upright position.

Another field of corn planted at a later date and visited by H. C. Heard and the writer on September 7 revealed a like rotting of the stalks. This field was about eight miles west of Phoenix in a soil that had never grown corn so far as the owner could ascertain. A much larger percentage of stalks were attacked by the disease than in the former field and the infection more confined to spots throughout the entire planting. All other symptoms and characteristics of the disease were identical with those above described. Specimens of the diseased stalks were sent to Prof. J. G. Brown, Plant Pathologist at the University of Arizona, who reported that in all probability the disease was identical with the bacterial stalk rot of corn first described from Arkansas. The organism has later been described in Phytopathology (Vol. 12, p. 497) by H. R. Rosen as *Pseudomonas dissolvens* n. sp.

During the season of 1922 an outbreak of the cluster-cup rust (*Aecidium* sp.), of cotton was found to be quite prevalent in the plantings near Tucson. The first report of the disease was furnished this office on September 1, by Roy Nixon, a Field Scout employed in the cotton inspection work. Further investigation showed that the disease was quite widespread locally and in some instances caused defoliation of the plants. A thorough inspection of the cotton acreage in the Salt River and Yuma Valleys failed to reveal the presence of the disease in either of the latter localities. Serious results from this outbreak are not anticipated as the disease has been known in the South for a considerable period of time and only in one or two instances has it assumed destructive proportions.

The head smut (*Sphacelotheca reiliana*), of sorghum, another disease which has not heretofore been reported as a parasite in Arizona agriculture was found in the vicintiy of St. Johns, Apache County, by C. R. Fillerup, County Agricultural Agent. The collection consisting of but a single head, was made on September 27, during a field observation tour under the direction of Mr. Fillerup. As no other diseased heads could be found it is surmised that the infection was a mere chance and resulted from the planting of seed imported from an area where the disease was prevalent.

Diseases of Deciduous Fruits, Small Fruits and Vines

Almond, apple, apricot, peach, pear, plum and quince trees were observed attacked by the various forms of the crown gall (*Bacterium tumefaciens*), organism. The development of the tree gall formation was found quite prevalent throughout the Salt River Valley, especially during the latter part of the growing season. Probably the most serious infested trees were found in a plum and apricot orchard near Glendale. In this particular orchard quite a number of the trees had become completely girdled at or just below the soil surface and had succumbed. A goodly number of other trees in the same orchard were found to have large galls but were still alive and had produced a good crop of fruit.

The hairy root type of development caused by the same organism was found in a serious form upon several apple trees in an orchard near Thatcher. One tree in particular had apparently been killed by the disease and was therefore dug out and examined. The entire fibrous root system was a dense mass of matted and interwoven rootlets which had ceased to function.

The aerial gall form of disease was observed upon an apple tree in an old orchard near Pima and upon several quince trees in the Camel Back Mountain district near Phoenix. Judging from the age of the tree near Pima and the evident growth of galls for an extended period, this stage of the disease is much less serious than those mentioned previously.

Another disease that results seriously to the deciduous fruit of Arizona is the Texas root rot (*Ozonium omnivorum*). It was found quite frequently causing the death of such trees as almonds, apricots and peaches, in the Salt River Valley. In the orchards of the upper Gila Valley especially near Safford and Thatcher, the disease was found in the roots of apple trees and in all probability was instrumental in causing the death of many of the trees in that district. This disease has also been reported as causing the death of an entire orchard of young apples near Kirkland, the killing progressing steadily until the present season when it became most severe.

A young fig orchard near the Salt River, south of Phoenix was very seriously injured by this disease during the season of 1922. The trees had attained an average height of about three feet when the deadly organism appeared to become most virulent and approximately 50 per cent of the entire planting was killed in less than two weeks time. The trees were set in a soil that had previously grown a cotton crop which had been destroyed by the disease.

Fire blight (*Bacillus amylovorus*), of apple and pears was of minor importance in Arizona during 1922. An outbreak of blossom blight occurred in a pear orchard near Yuma, which was the only serious manifestation of the disease throughout the season. The pear trees of the Salt River Valley were especially free from any manifestations of the disease as not a single instance of blight occurrence was observed or reported.

A number of disturbances of fruit trees not associated with an organism of bacterial or fungous nature were evident throughout the season. Among these was the rosette of apple trees, found in an orchard near Eagar, the sun scald and frost injury to branches and foliage of apples throughout the fruit producing districts of Navajo and Apache Counties, and the gummosis and chlorosis of the stone fruit trees throughout the southern part of the State. A peculiar leaf spotting of apple trees was discovered near Safford and again near Shumway but could not be attributed to any known parasite. Hail and storms also did some damage in northern Arizona.

The leaf spot disease (*Septoria rubi*), of blackberries was the only disease of small fruits that appeared to be generally prevalent in the State. Specimens of this disease were sent in from Clifton upon two varities of blackberries, while the same trouble was quite frequently observed in the berry plantings throughout Navajo and Apache Counties. The report from Clifton indicated that some shedding of the foliage was apparent.

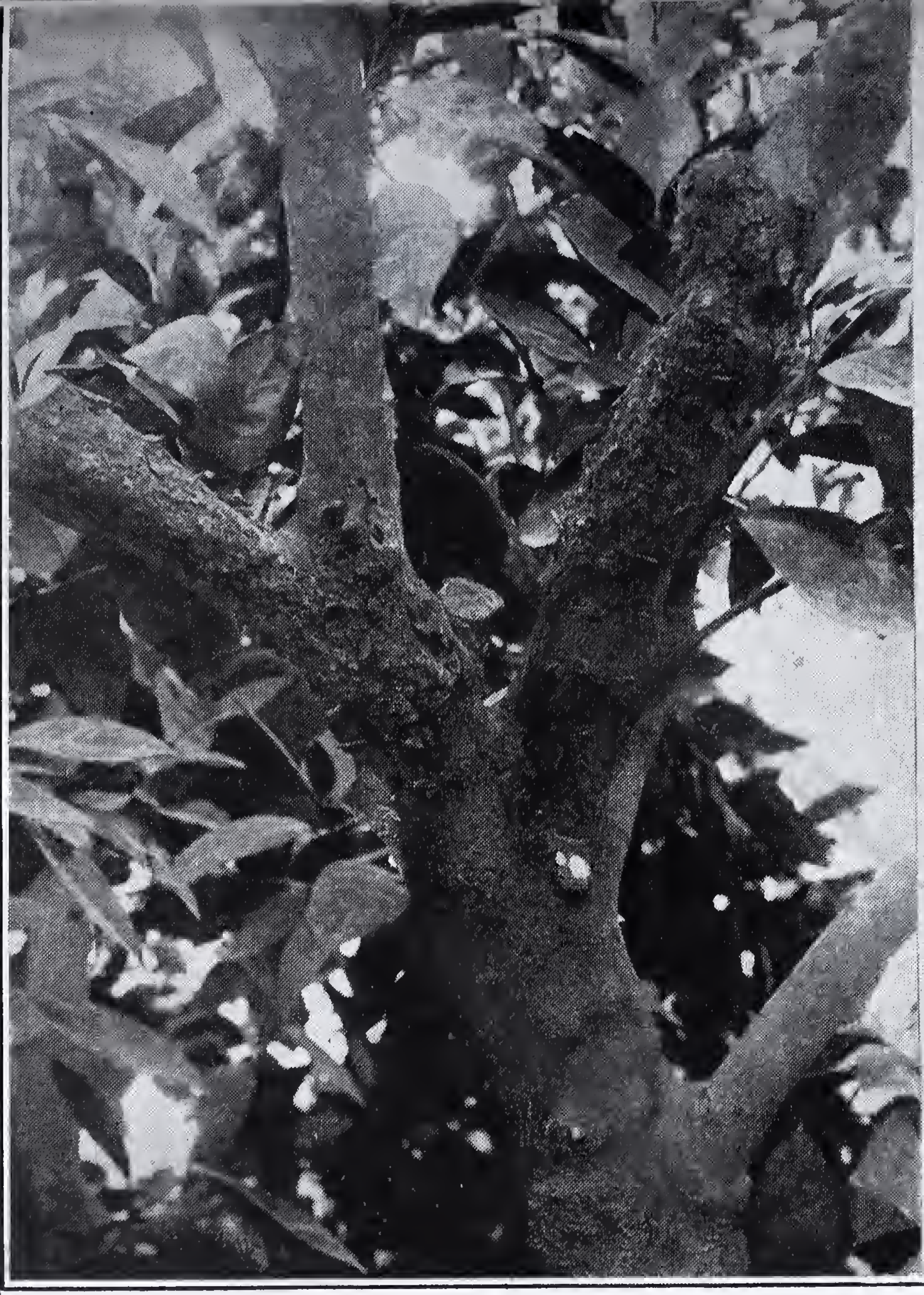
The grape shrivel, a trouble probably associated with moisture relations, was found throughout the Salt River Valley on some varieties. The attack, however, was much less noticeable than during 1921, when it assumed seriousness in several vineyards. The Flame Tokay variety of grapes seems to be especially subject to this malady.

The grape powdery mildew (*Uncinula necator*), was very markedly absent during 1922.

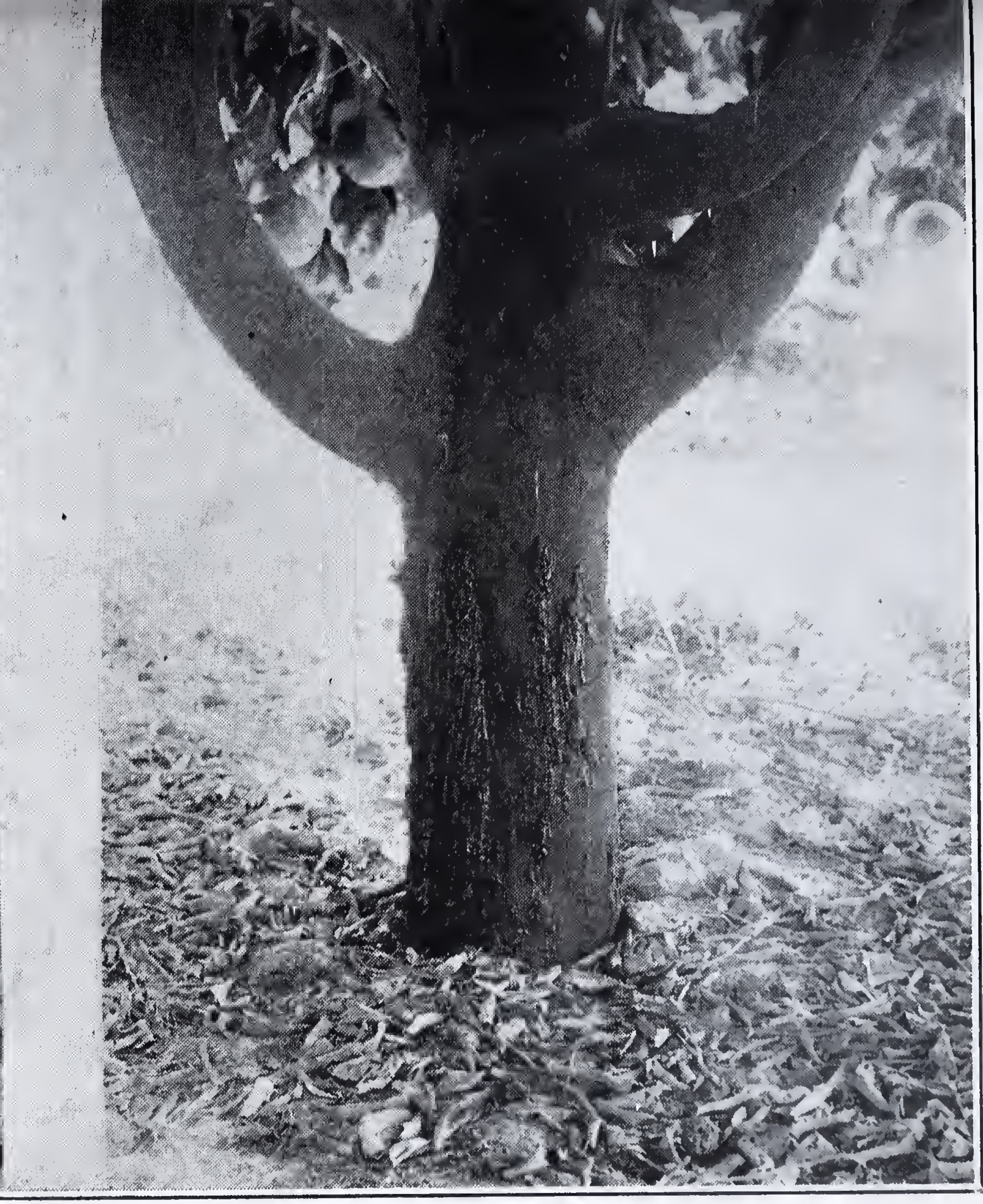
Citrus Diseases

At least two citrus seed beds grown in the shade of lath houses, were found to be attacked by one of the Damping Off fungi. The young plants had made a very promising start in both beds when the Damping Off became noticeable. Specimens were brought to the laboratory and kept in a moist chamber for a few days when it was found that the fungus *Rhizoctonia* had developed abundantly. A change in the method of watering and a diminution of the supply for a short period resulted very favorably in stamping out the disease in the most seriously affected bed.

The brown rot gummosis (*Pythiacystis citrophthora*), caused some damage during the season. The most conspicuous attack was upon a group of grapefruit trees in a grove northwest of Phoenix. The lower part of this grove was in the path of the Cave Creek Flood of 1921 and as the water receded a deposit of silt and debris collected at the base of the trees and covered the bud unions. As the grapefruit bark is much more susceptible to this organism than the sour stock bark, it is evident that infection occurred following the conditions named, and



1. Psorosis or scaly bark on citrus tree.



2. Brown rot gummosis on citrus tree.

caused the serious gum flow that was evident during the 1922 season.

Another instance of the same disease was found in a young Navel orange grove where the infection had gotten in above the bud union. This was partly due to the grower having allowed the tree protectors to remain in place for too long a period during which time much dirt, sand and other material had collected. Following irrigations the moisture collected at the base of the trees in this refuse and created ideal incubation condition for the fungus. A number of young trees were apparently killed by this means. (Plate XII, Fig. 2.)

The Black Rot (*Alternari citri*), of the Navel orange, a disease very much in evidence during 1921, was much less prominent in 1922. In order to determine the relationship of this rot to the Navel orange worm (*Myelois venipars*), collections were made weekly from the time of the shedding of the petals up to the last week in August. Our observations, both in the field and laboratory work, lead us to conclude that the entrance of the organism into the navel end of the fruit is purely secondary in nature and occurs only when cracks or splits or other imperfections are found upon the skin or peel. The first collection of the season showing the presence of the organism was taken on June 10. After being held in a moist chamber for a week a single fruit was found containing Alternaria spores. No further invasion was found until June 30, when three fruits contained the fungus. A month later, July 31, the spore stage was found upon the fruits brought in from the groves. During the remainder of the season no difficulty was experienced in obtaining the mature spore forms from cracked, split or otherwise imperfect fruit. At approximately the same time the fungus began to be found frequently, the Navel orange worm was collected. Observations carried on through the remainder of the season indicate that no relationship between the rot and worm exists, save that the general conditions of the fruit which seems to favor simultaneous entrance.

Psorosis or scaly bark, a trouble of unknown origin, was present in some of the older citrus plantings but in no instance in especially serious form. A number of the growers have practiced treating the trees with Bordeaux paste and the results are very gratifying. Trees that have reached full maturity are most apt to be attacked. (Plate XII, Fig. 1.)

Diseases of Field and Forage Crops

The field and forage crops in Arizona during 1922 suffered no more serious attack from parasitic diseases than in the average years. Alfalfa was attacked by the Texas root rot (*Ozonium omnivorum*), in practically all parts of Southern Arizona. The most severe killings called to our attention were in the upper Gila Valley between Pima and Solomonsville. The spore stage (*Phymatotrichum omnivorum*), was observed in abundance in a field near Alhambra. The leaf spot (*Pseudopezizza medicaginis*), was prevalent on the early cuttings but not serious enough to cause much defoliation. Several alfalfa fields near Snowflake showed the fall attacks of the downy mildew (*Peronospora trifoliorum*).

Barley was slightly damaged throughout the State by the loose and covered smuts, (*Ustilago nuda, Ustilago hordei*). The latter proved to be quite serious in the region of Nutrioso in Apache County. The black stem rust (*Puccinia graminis*), was prevalent in northern Arizona where the rainfall was more plentiful. Corn smut (*Ustilago zeae*) was apparent in nearly all the corn fields visited both in Northern and Southern Arizona. The loose smut (*Ustilago avenae*), of oats was noticed near Flagstaff and Lakeside but was scarce in the Salt River Valley. The black stem rust (*Puccinia graminis*), was collected near Eagar in oats stubble and from appearances must have been quite serious. The kernel smut (*Sphacelotheca sorghi*), of sorghum appeared scattered throughout the fields near St. Johns. A small field of Sudan grass near Yuma, was found almost completely destroyed by the bacterial blight (*Bacillus sorghi*).

Wheat was slightly attacked by the bunt or stinking smut (*Tilletia tritici*), also the loose smut (*Ustilago trictici*). The black stem rust (*Puccinia graminis*), was prevalent in northern Arizona but was observed in but a single field in the Salt River Valley.

Diseases of Vegetable and Truck Crops

Throughout northern Arizona, and especially in the bean growing districts of Navajo and Apache Counties, the bacterial blight (*Pseudomonas phaseoli*), was prominent. Several large bean fields near St. Johns were practically destroyed by the disease. Weather conditions proved very favorable for the rapid spread of the blight and many of the growers were of the opinion that the grain bugs (*Chlorochroa sayi*), were also instrumental in its dissemination. As these insects were very numerous in the bean fields during the month of September, after the blight had caused the major portion of the damage, it is quite likely that this relationship existed.

Cantaloupes, casabas and muskmelons in the region previously mentioned were severely attacked by the anthracnose (*Colletotrichum lagenarium*), disease. According to growers this disease has been present for a number of years, but never so serious as during 1922. It is evident that the summer rains and the prevailing temperatures that existed were the factors responsible for the damages caused during the season. Several cantaloupe fields were visited near St. Joseph and St. Johns, where at least 50 per cent of the crop had been injured.

A field of onions near Alhambra was found to be quite badly injured by the bacterial soft rot (*Bacillus carotovorus*). These onions had been allowed to remain in the field after maturity, and the soil became badly overgrown with Johnson grass. A slight summer rain followed by a period of high temperature, coupled with the failure of the grower to "break" the stalks resulted in the infection. As the crop was harvested, instead of being thoroughly dried it was piled in heaps and covered with the weeds and Johnson grass. Many of the onions were found to be moist when examined. This practice likewise favored the development of the rot.

Potato diseases during the 1922 season were somewhat less severe than usual. On the other hand the area devoted to this crop in Arizona was 2000 acres above the 1921 acreage. Scab (*Actinomyces scabies*), was found in a field near Glendale as early as May 25. It was also observed in several small patches near Lakeside in rather severe form.

The *Rhizoctonia* disease was in evidence throughout most of the potato districts of the State, but was less severe than usual in the Flagstaff region and extremely light in the Salt River Valley. The early blight (*Alternaria solani*), owing to late rains, did not develop to any extent until the latter part of the season. It was present, however, throughout the Flagstaff region and in practically all of the districts of Navajo and Apache Counties. The dry rot (*Fusarium* sp.), of the stem end, sometimes plentiful in the Flagstaff region was of minor importance.

A large field of sweet potatoes south of the city limits of

Phoenix near the Salt River were very seriously injured by the Texas root rot (*Ozonium omnivorum*). The disease did not kill the vines to any extent but confined its attacks to the "root tubers" or potatoes proper, and retarded their growth and development. The cinnamon colored wefts or strands of the fungus were so plentiful upon the shrivelled and undeveloped potatoes that they could be easily observed with the unaided eye. Many potatoes had the appearance of being completely enmeshed in these strands.

Anthracnose (*Colletotrichum lagenarium*), the same disease found upon the cantaloupe, casabas and muskmelons of Northern Arizona was equally severe upon the watermelons in the same districts. Probably the greatest loss from this disease was observed near St. Johns where several large fields were practically ruined. The summer rains no doubt favored the disease as most of the loss occurred following this period. The majority of the fields had set a heavy crop of melons which were about one-half grown when the disease became most virulent. Practically all the leaves and runners were destroyed, leaving the melons immature and therefore worthless. When observed in September the characteristic spots producing the spore forms were numerous upon the melons still in the fields. So far as could be learned not a single grower resorted to spraying for the control of the disease. The same disease was also observed in a field of late melons in Yuma.

Cotton Diseases

The angular leaf spot or black arm (*Bacterium malvacearum*), in several instances during the past few years being the most serious disease of Arizona cotton, appeared in only a few isolated spots during the 1922 season. As in the past the severity of the outbreak was associated with climatic conditions. The greatest damage called to our attention was in an area north of Marinette. A severe hail storm in that particular locality so injured the plants that the entrance of the organism was comparatively easy. Throughout the center of the storm swept area the loss was exceedingly heavy, while a mile distant in each direction the loss from the disease was negligible.

The Texas root rot (*Ozonium omnivorum*), was less serious throughout the Salt River Valley than in former years, but assumed seriousness in the Yuma district near Somerton. A number of large fields in the infested area were almost a total loss owing to the severity of the attack. Unusual climatic conditions probably were accountable for this outbreak as the most rapid development of the disease was associated with a period of high humidity.

An item of especial interest in connection with the severe outbreak of the disease in this community was the most copious development of the spore stage (*Phymatotrichum omnivorum*), ever observed by the writer in an Arizona cotton field. The early symptoms of the root rot disease began to show in a field of very rank growth, and the grower thinking the plants in need of water, applied a heavy irrigation. Following the irrigation many of the more rank growing plants in certain spots fell over and became lodged and matted together, forming a mass of vegetation through which the sunshine failed to penetrate. In practically all of these lodged areas a number of plants were killed by the organism. By raising the fallen plants and examining the soil, great patches of the creamy-white spore stage was found to have developed. These patches ranged from small individual spots, to united growths covering areas more than ten feet in circumference. A careful examination showed that where the plants still stood in the upright position the spore stage was seldom found. It is evident that the lodging of the plants, associated with a high humidity and the high temperatures, created conditions highly favorable for the development of the spore stage of this fungus.

The sore-shin (*Rhizoctonia* sp.), owing to the favorable spring weather was of minor importance. Some evidence of the disease was found in the heavy adobe soils but none appeared in the lighter, more quickly warmed soils.

During the latter part of the growing season a black leaf spot was abundant throughout the entire cotton districts of the State. No damage can be ascribed to this disease.

A number of minor troubles such as chlorosis, sterility, red-leaf and the secondary boll rots were observed and reported.

Nematodes

The soils of Southern Arizona, especially those of the lighter types are often found infested with nematodes. The disease manifests itself as small knots or galls upon the roots of the plants. These are caused by the action of a minute eel-worm

(*Heterodera radicicola*), which bores into the rootlets and imbeds itself in the soft cellular tissue which is richest in food material. Herbaceous plants when badly attacked are dwarfed and stunted but seldom killed. The fruit, however, of such plants is practically worthless because of lack of sufficient food material. The disease in Arizona is especially severe upon apricots, almonds and peaches, causing a greater percentage of loss than any other single disease common to these crops in the State.

A tree suffering from nematode attack may persist for several years, the death being gradual rather than sudden. Provided that sufficient plant food is present the tree often is able to produce a good fruit crop as well as supply the necessary food material for the parasite. Such trees have been observed for several seasons in the Salt River Valley. When conditions become such that the nematodes flourish at the expense of the tree the result is disastrous.

Fig trees in Southern Arizona are probably more subject to nematode attack than any other host plant. Figs, however, are seldom killed as the trees seem to be able to develop a new root growth as fast as the infested ones are destroyed.

The following host plants were found to be attacked by nematodes during the 1922 season, almond, apricot, cantaloupe, cowpea, fig, peach, plum, tomato and watermelon.